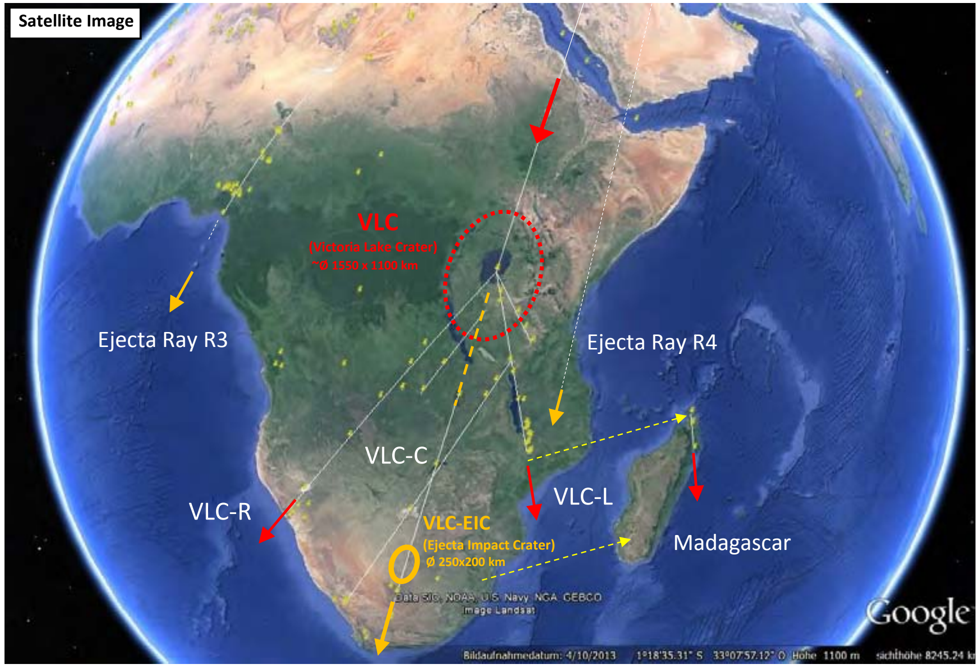
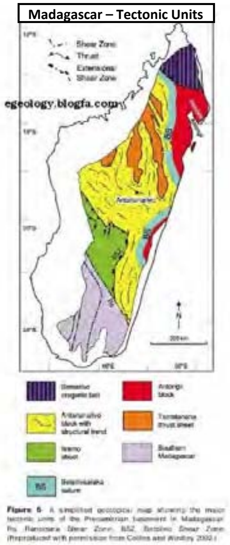
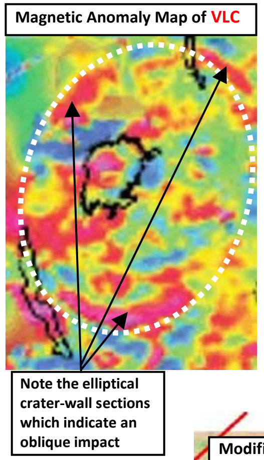
4a-2 A powerful Ejecta Ray from the Victoria-Lake Impact Event (~Ø 1550 x 1100 km) started the separation of Madagascar from Africa

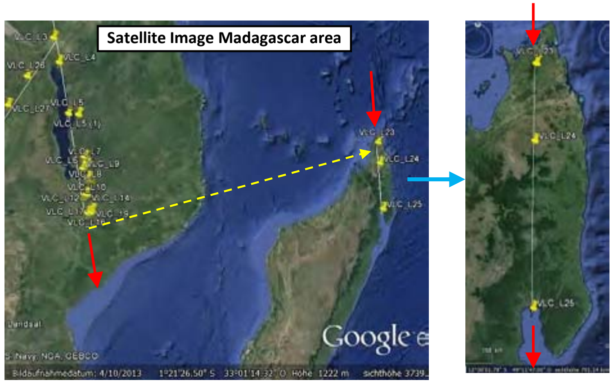
The separation of Madagascar from the African Plate was initiated by secondary impact events which were caused by the Permian-Triassic (PT) Impact ~253 Ma ago. Especially the secondary impact which caused the **"Victoria Lake Crater" (VLC)** contributed to this separation of Madagascar from Africa. This powerful Impact Event, which was an oblique impact, and which occurred in the Victoria Lake area, produced two strong "ejecta wings" or ejecta rays (VLC-R & VLC-L) and a "Central Ejecta Ray" (VLC-C) which caused the Iron-Ore Deposits in South-Africa (→EIC). From the location and shape of the secondary impact structures caused by the Victoria Lake Impact (→ yellow pins on satellite map → see following pages !), the orientation of the two ejecta wings and the trajectory of the main impactor can be reconstructed. This provides strong evidence that the VLC was caused by the PT-Impact. (→ similar to the Bengal Bay Crater). In all probability the impact impulse of ejecta ray VLC-L (L=left), which runs from the VLC over Malawi Lake (→ a result of the impact of VLC-L) towards the original position of Madagascar, caused fractures (→ on the western border of the Madagascar-Fragment) which are responsible for the break-off of Madagascar from the African Plate. This happened at the same time when Ejecta Ray R4 caused a major fracture between Africa and Australia/India (→ see modified map below) Gravity Anomaly- & Topographic- Structures provide further evidence for this scenario. And Gravity Anomaly- & Magnetic-Anomaly Structures also confirm the VLC-Impact Scenario.



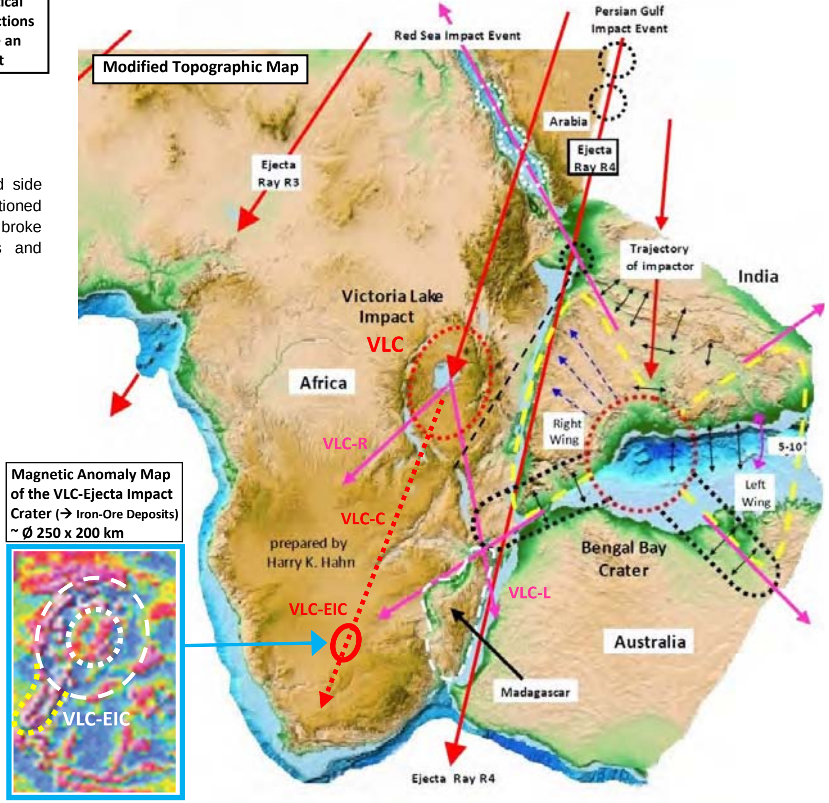




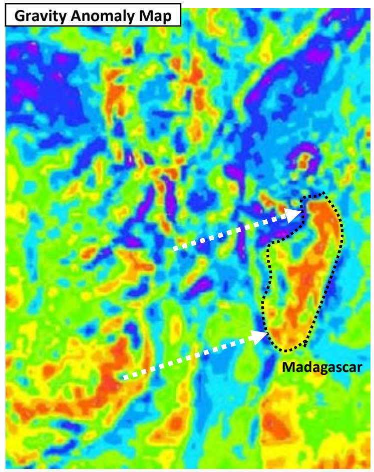
Note the elliptical crater-wall sections which indicate an oblique impact


Satellite Image Madagascar area
Google
Bildaufnahmedatum: 4/10/2013 1°21'26.50" S 33°01'14.32" O Höhe 1222 m sichthöhe 3739

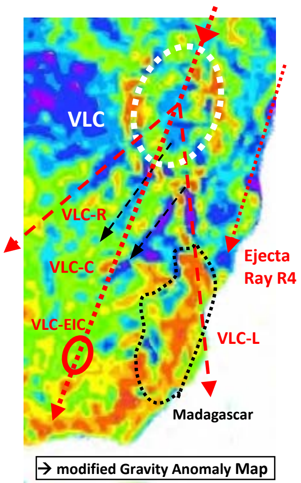
The modified Topograhic Map on the righthand side shows how Africa, India and Australia were positioned to each other, and how this land area of Pangea broke apart, caused by the powerful Ejecta Rays and Secondary Impactors from the PT-Impact Event.



Madagascar – Position Today

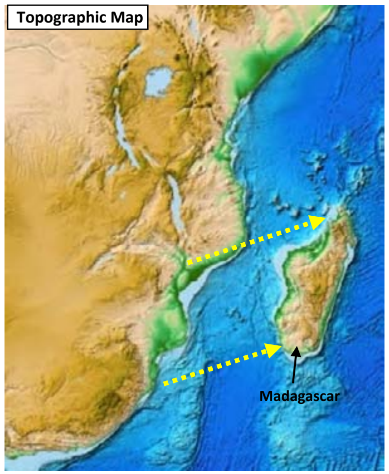


Madagascar – Original Position

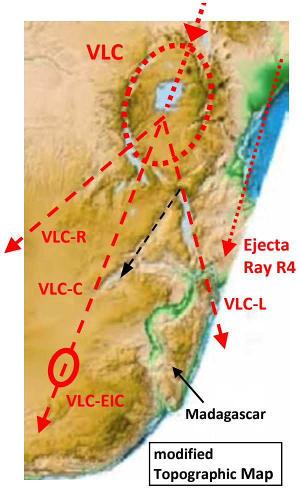


→ modified Gravity Anomaly Map

Madagascar – Position Today



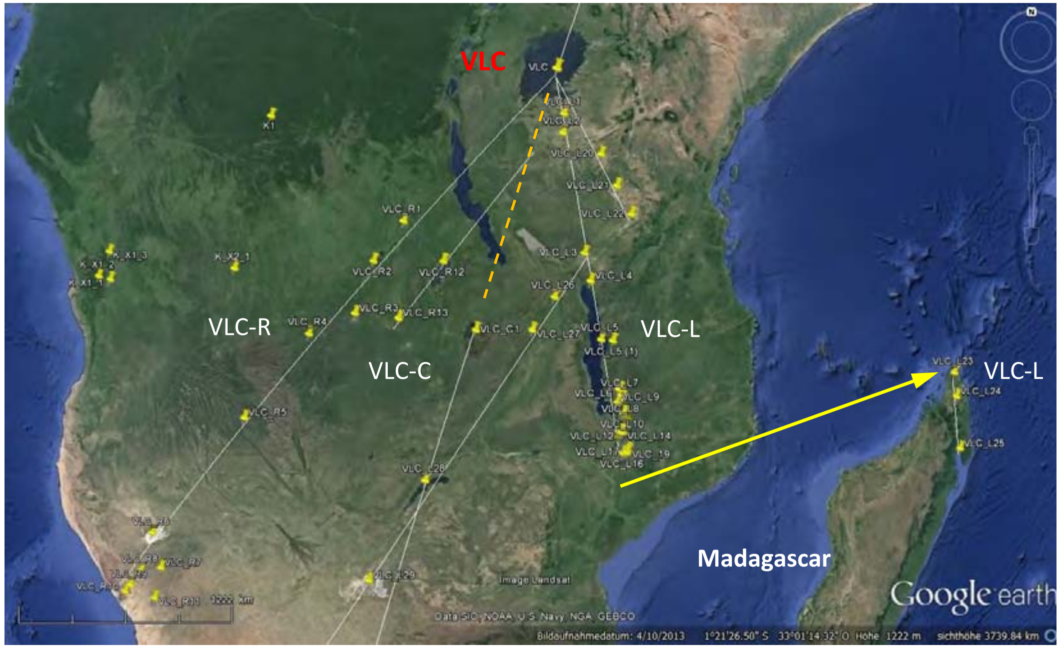
Madagascar – Original Position

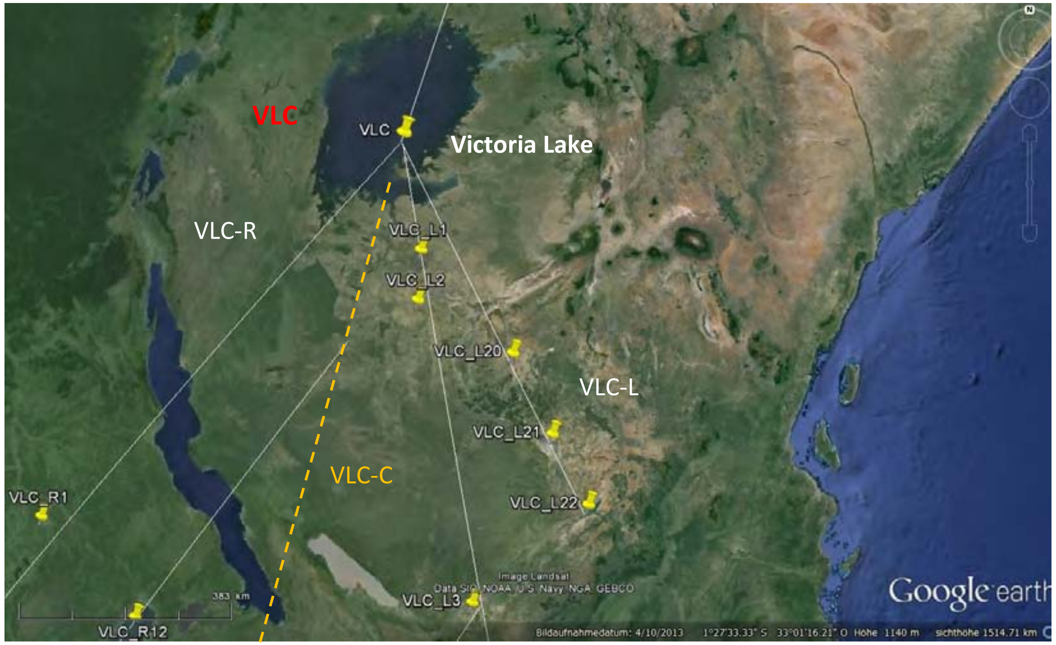


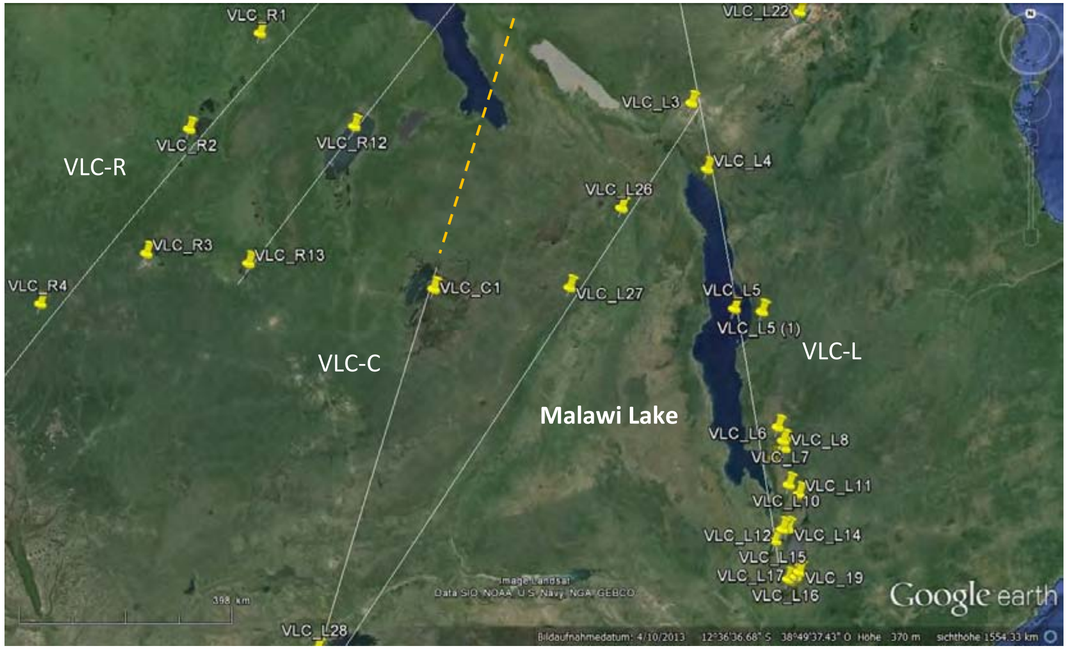
Magnetic Anomaly Map of the VLC-Ejecta Impact Crater (→ Iron-Ore Deposits) ~ Ø 250 x 200 km

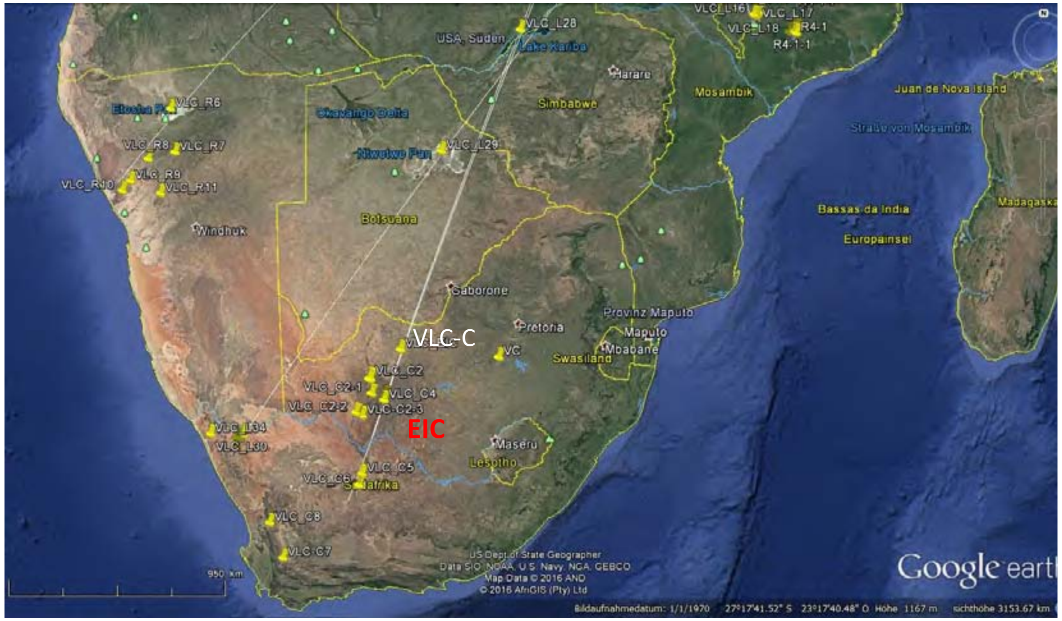
Overview of the locations of selected Secondary Impact Structures, caused by the VLC-Impact Event

The secondary impact structures are mainly located along the Ejecta Rays (ejecta wings) VLC-L & VLC-R, along the Central Ejecta Ray VLC-C , and along other (secondary) ejecta rays which branch off from the main ejecta rays. The left Ejecta Ray VLC_L ends on the African Plate around 300 km south of the southern end of Malawi Lake. But there is strong indication that it continuous in the North of Madagascar. If this is correct, then this would constrain Madagascar's original location precisely to the location shown on the first page of this document. The Central Ejecta Ray VLC-C ends in South-Africa were the ejecta from the VLC has caused extensive Iron-Ore deposits → a further proof for the Impact Hypothesis

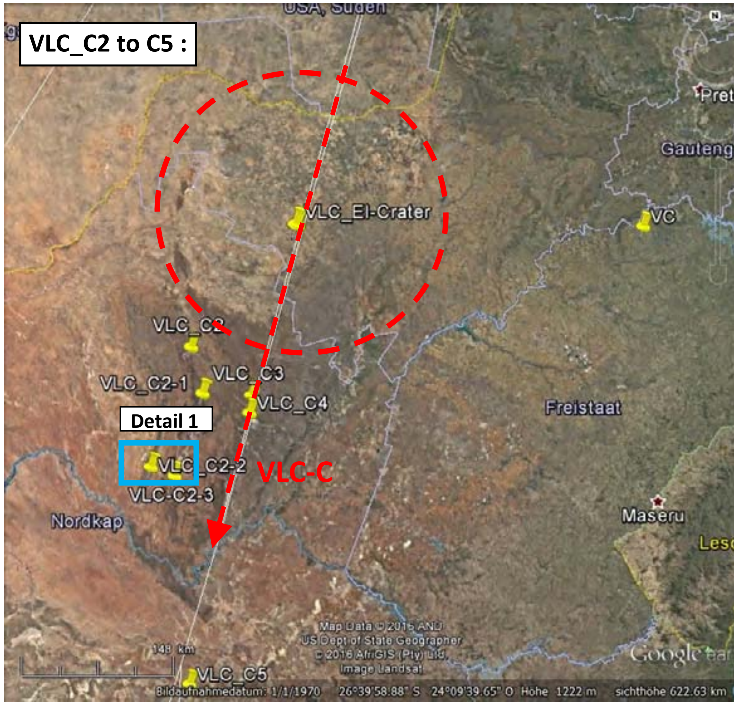



VLC
VLC
Victoria Lake
VLC-R
VLC_L1
VLC_L2
VLC_L20
VLC-L
VLC_L21
VLC-C
VLC_L22
VLC_R1
383 km
VLC_L3
VLC_R12
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth
Bildaufnahmedatum: 4/10/2013 1°27'33.33" S 33°01'16.21" O Höhe 1140 m sichthöhe 1514.71 km



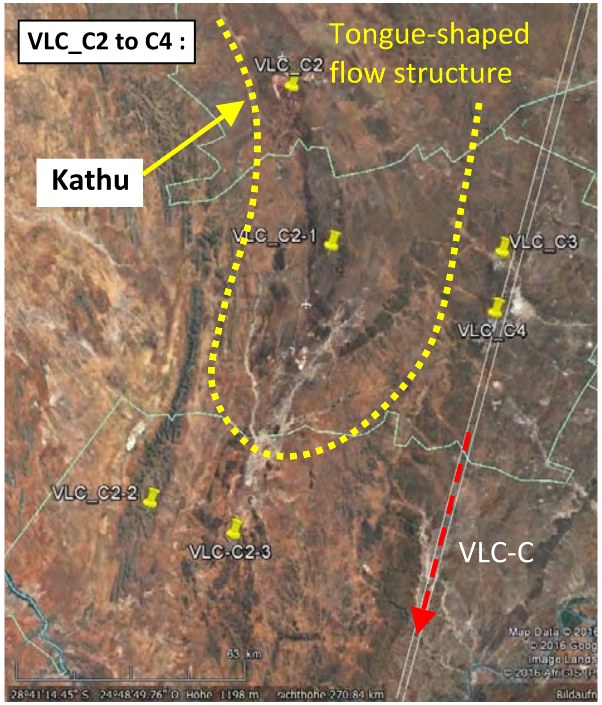


The Ejecta Impact Crater (EIC) Ø~ 250x200 km, located on the VLC-C (Central) Ejecta Ray of the VLC caused Iron-Ore Deposits in South Africa


VLC_C2 to C5 :
USA, Suden
Pret
Gauteng
VLC_El-Crater
VC
VLC_C2
VLC_C2-1
VLC_C3
VLC_C4
Detail 1
VLC_C2-2
VLC-C
VLC-C2-3
Nordkap
Freistaat
Maseru
Les
VLC_C5
148 km
Map Data © 2016 AfriGIS (Pty) Ltd, US Dept of State Geographer, Image Landsat
Google Earth
Bildaufnahmedatum: 1/1/1970 26°39'58.88" S 24°09'35.65" O Höhe 1222 m sichthöhe 622.63 km

Satellite Image - Ejecta Impact Crater (EIC) Ø 250x200km

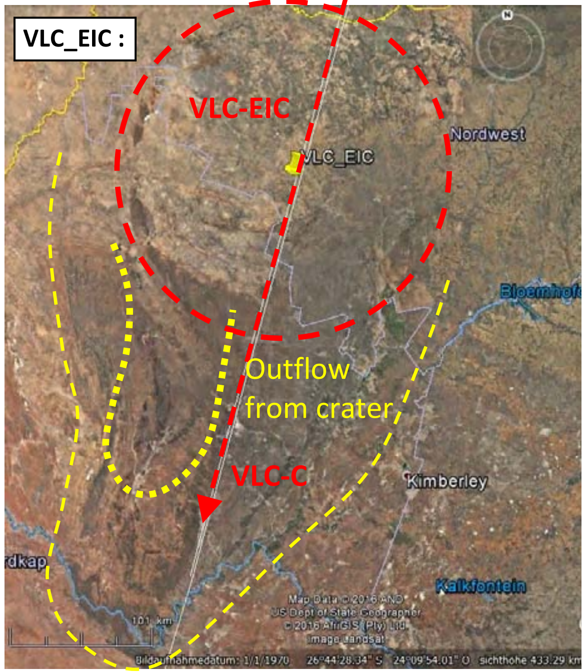
→ red arrow indicates the trajectory of theimpactor
yellow lines indicate flow direction of Ejecta


VLC_C2 to C4 :
Tongue-shaped flow structure
VLC_C2
Kathu
VLC_C2-1
VLC_C3
VLC_C4
VLC_C2-2
VLC-C2-3
VLC-C
63 km
Map Data © 2016 Google, Image Landsat, © 2016 AfriGIS (Pty) Ltd
28°41'14.45" S 24°48'49.76" O Höhe 1198 m sichthöhe 270.84 km
Bildaufn

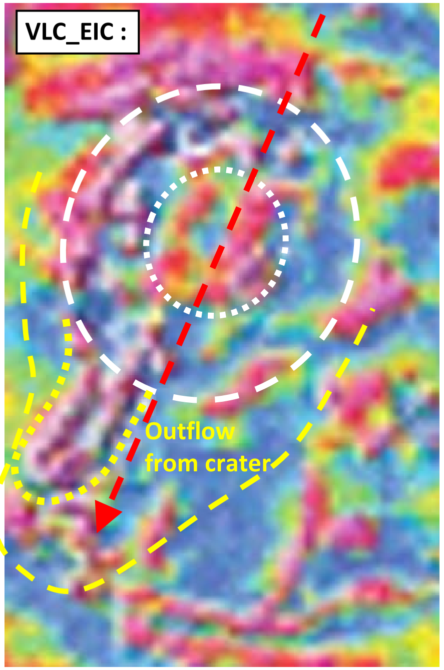
VLC-C2 : Kathu : → Iron-Ore Mines :

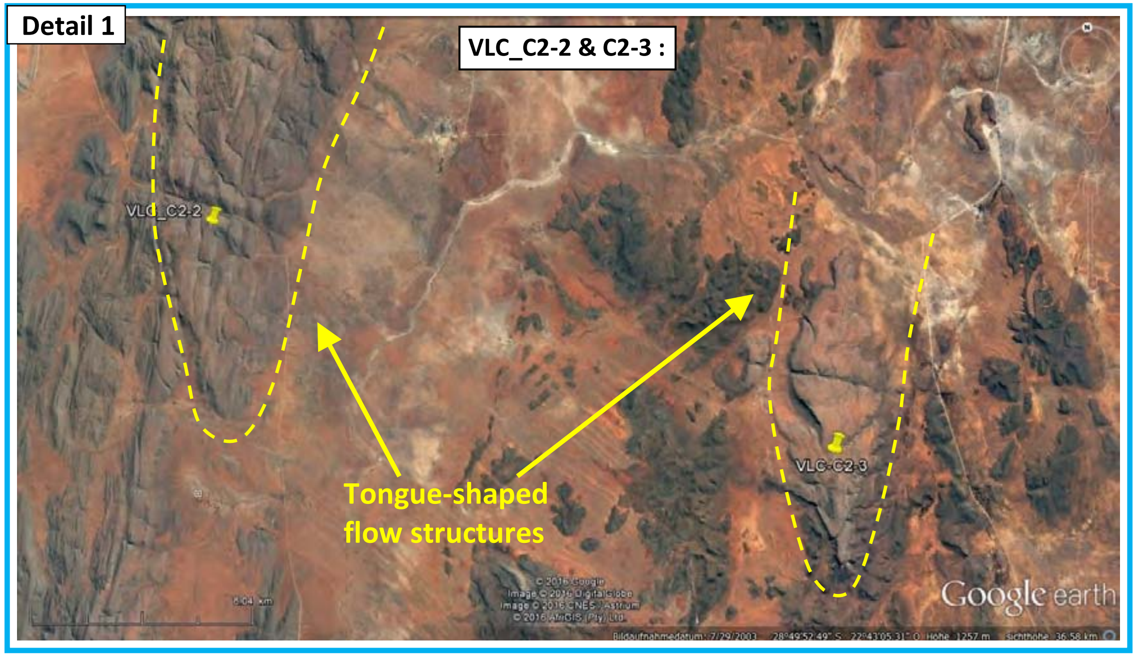
e.g. Sishen Mine 30km from Kathu is one of the largest Iron-Ore Mines in the world. Lump ore is extracted from a large Hematite ore body hosted by a Lake Superior-type banded iron formation (BIF) called Kuruman Formation (see also → manganese field). The lump to fine ratio of the Sishen ore is 60:40. The ore body measures approximately 14km long, 3.2km wide and 400m deep.

VLC-C2-1 : Postmasburg : → Iron-Ore (Hematite), Manganese Ore, Diamonds, Asbestos


VLC_EIC :
VLC-EIC
VLC_EIC
Nordwest
Bloemfont
Outflow from crater
VLC-C
Kimberley
dkap
Kalkfontein
101 km
Map Data © 2016 AfriGIS (Pty) Ltd, US Dept of State Geographer, Image Landsat
Bildaufnahmedatum: 1/1/1970 26°44'28.34" S 24°09'54.01" O sichthöhe 433.29 km

Magnetic Anomaly Map of EIC



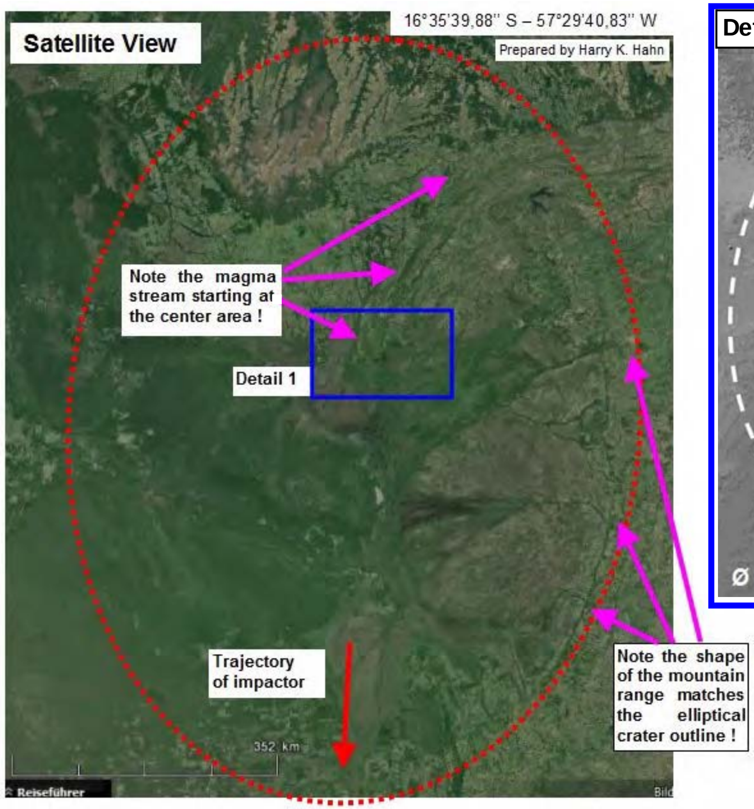

Detail 1
VLC_C2-2 & C2-3 :
VLC_C2-2
VLC-C2-3
Tongue-shaped flow structures
Google earth
Bildaufnahmedatum: 7/29/2003 28°49'52.49" S 22°43'05.31" O Höhe 1257 m sichthöhe 36.58 km

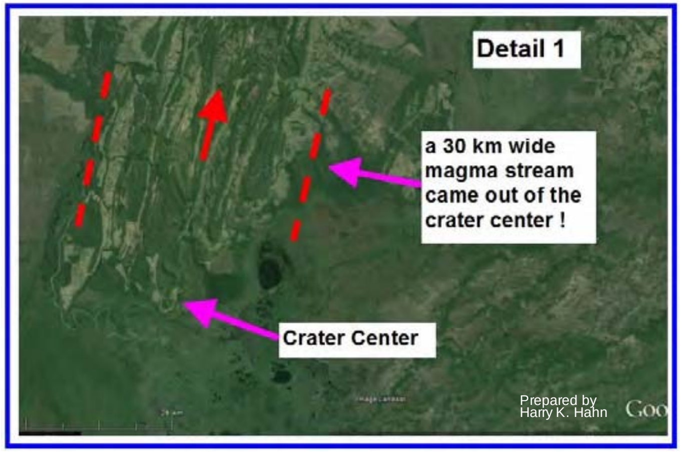
4b In South-America a large ∅ 840 x 630 km Crater exists, which may be connected to the PT-Impact 253 Ma ago

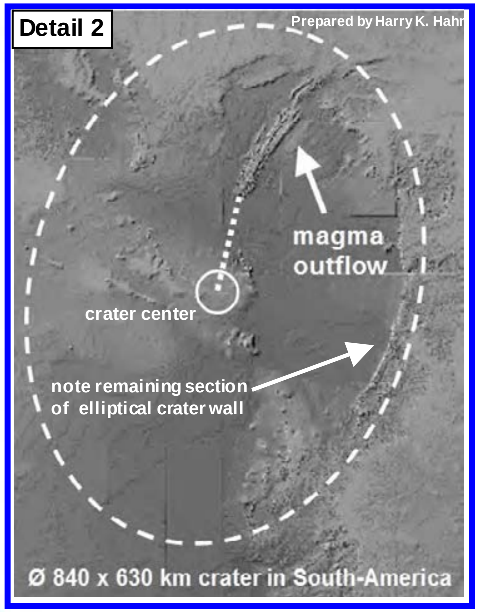
The orientation of this elliptical impact crater indicates that it may be a result of the PT-Impact too ! The special feature on this crater is a solidified magma stream which came straight out of its center ! This magma stream is 30 km wide and it surely had serious longterm effects on the climate ! The impact crater, which has formed the plane Pantanal area, has also caused an enormous crack in the lithosphere, which has triggered extensive Expansion Tectonics along the Andes in the East of South-America

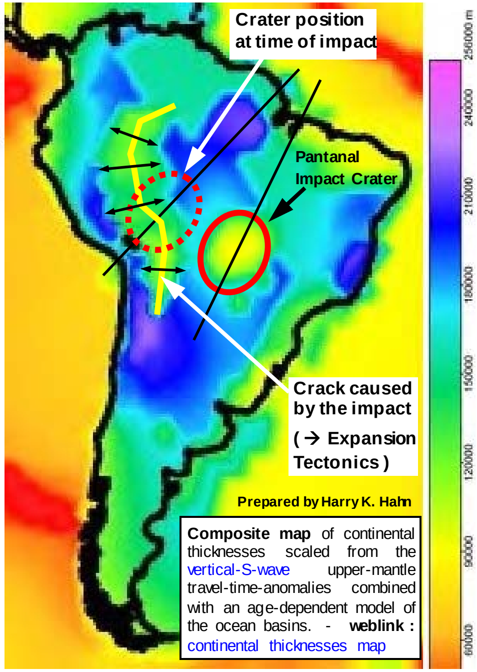
There are different maps which show clear evidence for this impact crater. The topographic map and the satellite map show the remains of the elliptical crater wall and of the magma stream, which flew out of the crater center. The topographic- and the magnetic anomaly map indicate that the crater position was located around 600 km towards the north-west at the time of impact. There are a number of features on the maps which clearly indicate this fact ! The continental (lithosphere)-thickness map shows a "crack", or a "stretching" of the lithosphere over a length of around 1500 km. This crack in the lithosphere runs along the eastern border of the Andes, from Bolivia through Brasilia and up to Colombia ! It is obvious that this enormous crater has caused a fracture though the north of the continent, and it led to Expansion Tectonics and maybe the CAMP-event, which produced > 1,000,000 km^2 of new surface area !!

This ∅ 840 x 630 km elliptical crater caused a > 600 km shift of the north-eastern part of the continent towards south-east. And it probably produced large areas with a great potential for large oil- & gas-fields (around the crater center)

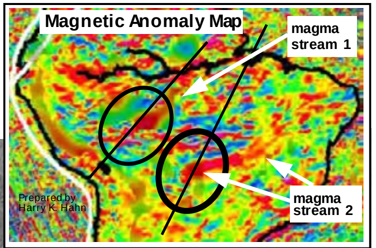

Satellite View
16°35'39,88'' S – 57°29'40,83'' W
Prepared by Harry K. Hahn
Note the magma stream starting at the center area !
Detail 1
Trajectory of impactor
352 km
Reiseführer
Note the shape of the mountain range matches the elliptical crater outline !


Detail 1
a 30 km wide magma stream came out of the crater center !
Crater Center
Prepared by Harry K. Hahn

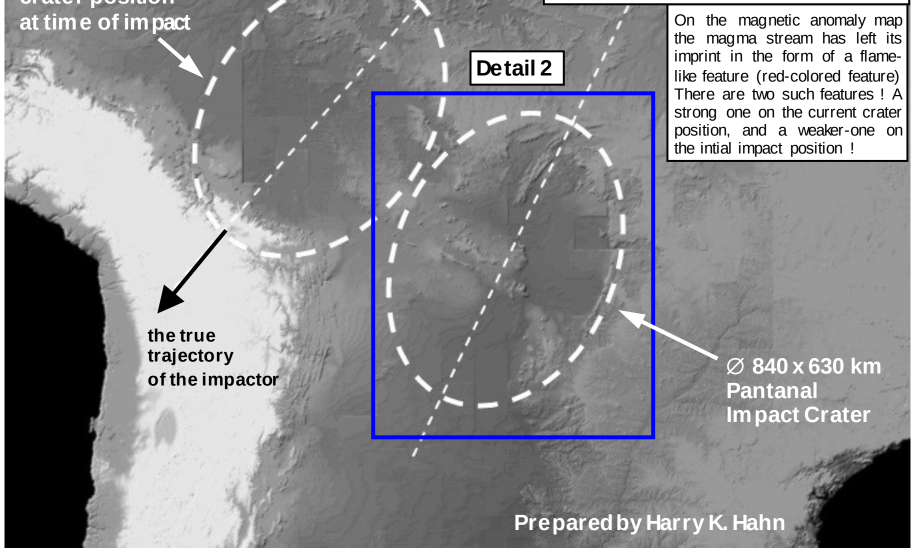

Detail 2
Prepared by Harry K. Hahn
magma outflow
crater center
note remaining section of elliptical crater wall
Ø 840 x 630 km crater in South-America


Crater position at time of impact
Pantanal Impact Crater
Crack caused by the impact
(→ Expansion Tectonics)
Prepared by Harry K. Hahn
250000 m
240000
210000
180000
150000
120000
90000
60000

Composite map of continental thicknesses scaled from the vertical-S-wave upper-mantle travel-time-anomalies combined with an age-dependent model of the ocean basins. - **weblink :** continental thicknesses map



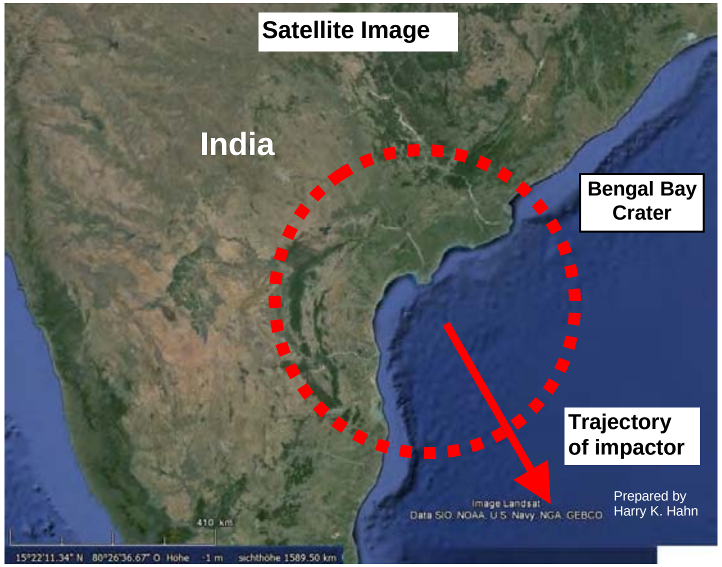
On the magnetic anomaly map the magma stream has left its imprint in the form of a flame-like feature (red-colored feature) There are two such features ! A strong one on the current crater position, and a weaker-one on the intial impact position !


Topographic Map
crater position at time of impact
Detail 2
the true trajectory of the impactor
∅ 840 x 630 km Pantanal Impact Crater
Prepared by Harry K. Hahn

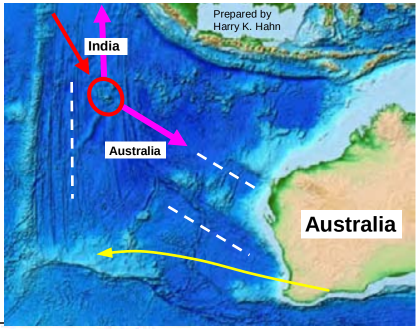
4c-1 A slightly elliptical impact crater in India with ∅ 450 x 380 km seems to be related to the PT-Impact Event.

This large elliptical crater is located at the center of India's east coast in the Bengal Bay. The assumed trajectory of the Ø **20** to **40 km** impactor which produced this large Crater indicates that this crater may be a large secondary crater of the PT-Impact Event 2 253 Ma ago. If we consider a rotation of India of 5-10° after the impact, and an arrangement of India to Australia, before the impact, as shown below, then this impact in India maybe the same impact as the one in NW-Australia ! This would mean that India & Australia had a slightly different arrangement to each other as generally believed !!

Elliptical crater ∅ 450 x 380 km in India

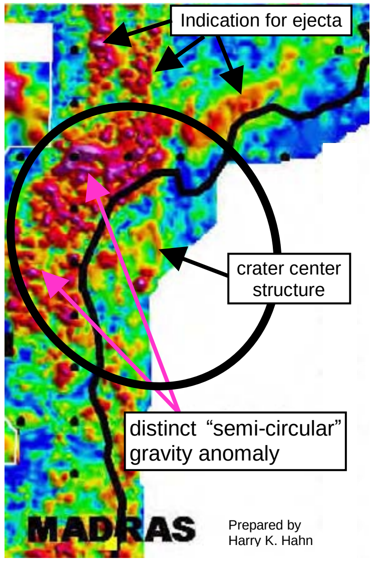


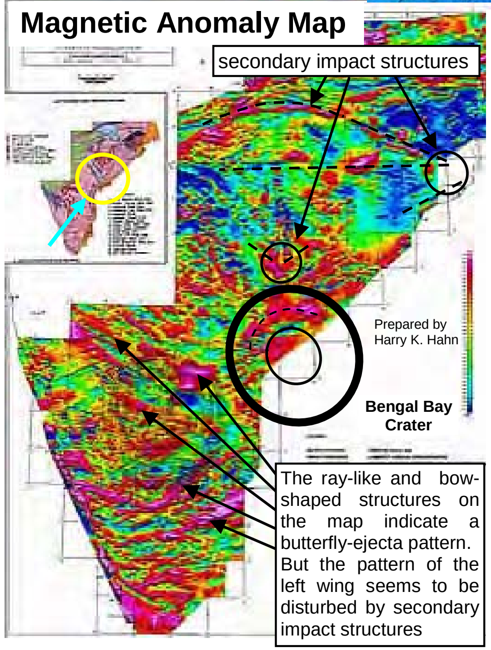
If this assumption is correct, then this large impact crater in India probably caused the break-off of India from Australia starting around 250 Ma ago (→ break-off of Pangea). Indication for this impact can be found on the topographic map, satellite image and on gravity- & magnetic anomaly maps of India. Because of the noticeable magnetic anomaly traces in the assumed ejecta pattern the impactor must have contained considerable amounts of iron. Because it was an oblique impact, the impactor produced a butterfly-shaped ejecta pattern (→ indicated in yellow on the map below). Here the ejecta structure is quite good noticeable within the right wing of the butterfly-ejecta pattern (→ indicated by the blue arrows). Therefore in all probability the Indian Traps are the result of an enormous ejecta blanket covering an area > 1,000,000 km^2 ! The Impact Crater initiated strong Expansion Tectonics (black arrows) → Compare with crater in NW-Australia



The ocean floor map shows traces of the movement of India and Australia after the Impact Event. These traces Indicate a fast movement of India directly towards North (plus an anti-clockwise rotation by 5-10°), probably caused by the ejecta impulse, and a movement towards SE by Australia.

Gravity Anomaly Map


Indication for ejecta
crater center structure
distinct "semi-circular" gravity anomaly
MADRAS
Prepared by Harry K. Hahn

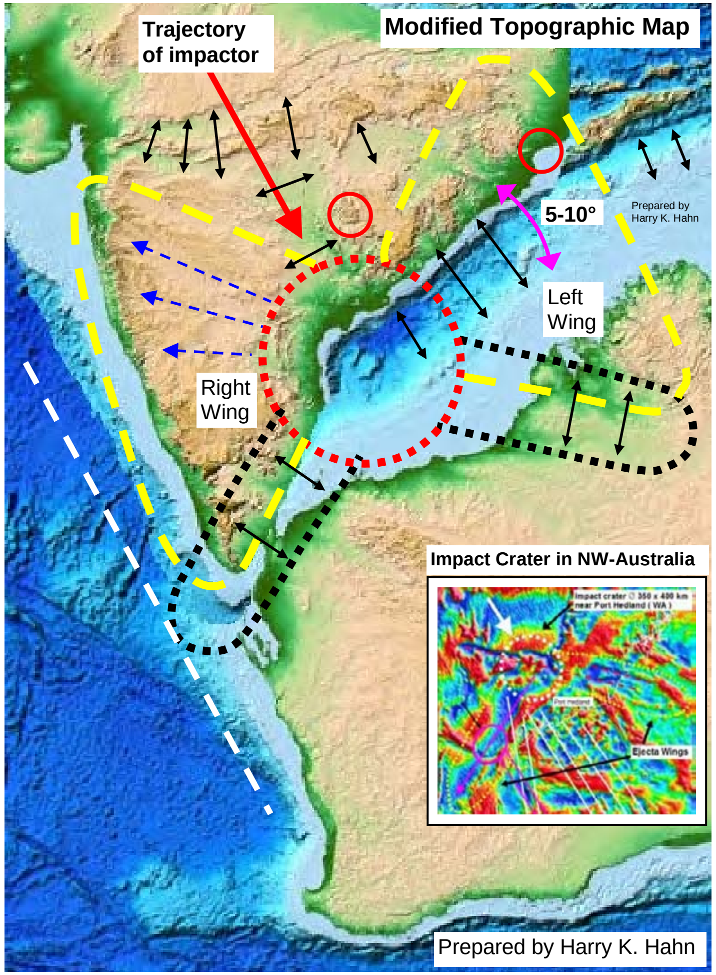


The ray-like and bow-shaped structures on the map indicate a butterfly-ejecta pattern. But the pattern of the left wing seems to be disturbed by secondary impact structures

---

The gravity anomaly map and the magnetic anomaly map give indication for a large impact crater and for an extensive ejecta pattern. However only half of the whole crater structure is visible because the other half is located on the ocean floor → or in all probability in NW-Australia !!

The fact that the center of the crater lies precisely on the coast (or in a bay) is a strong indicator that this crater may have caused the break-off of India from Pangea

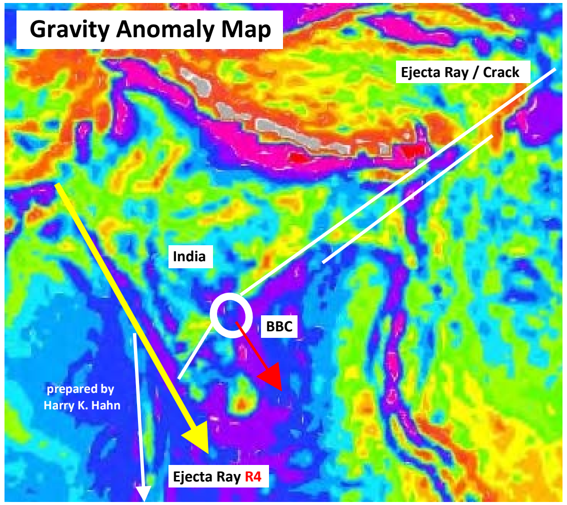

Trajectory of impactor
Modified Topographic Map
5-10°
Prepared by Harry K. Hahn
Left Wing
Right Wing
Impact Crater in NW-Australia
Impact crater ∅ 350 x 400 km near Port Hedland (WA)
Port Hedland
Ejecta Wings
Prepared by Harry K. Hahn

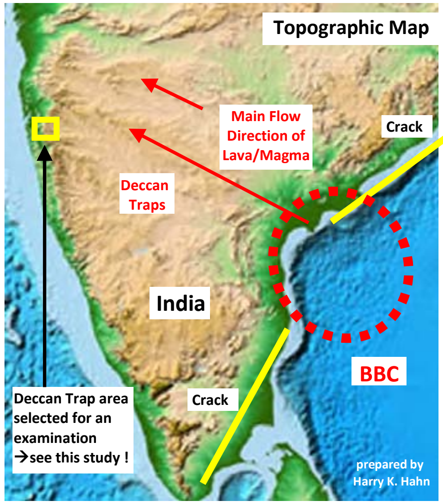
4c-2 The separation of India from Africa was initiated by a powerful Ejecta Ray (R4) from the PT-Impact Event ~253 Ma ago

The impactor which caused the Permian-Triassic Impact Crater also produced a number of powerful Ejecta Rays and large Secondary Impactors which caused a global fracture pattern in Earth's crust, which then triggered the break-up of Pangea. The powerful **Ejecta Ray R4** caused an immense crack in the Super-Continent Pangea which defined the eastern border of the African Plate on one side and the western border of the Indian Plate and the Australian Plate on the other side. Another large crack in Pangea's crust was caused by the Bengal Bay Impact which defined India's western border & Australia's NW border and started their separation

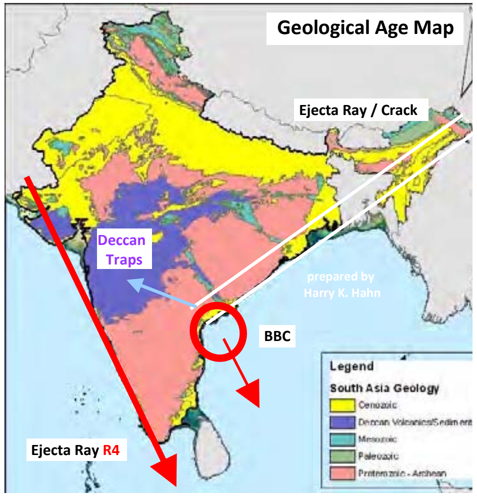
Gravity Anomaly Maps provide evidence that the Indian Plate was formed by Ejecta Rays

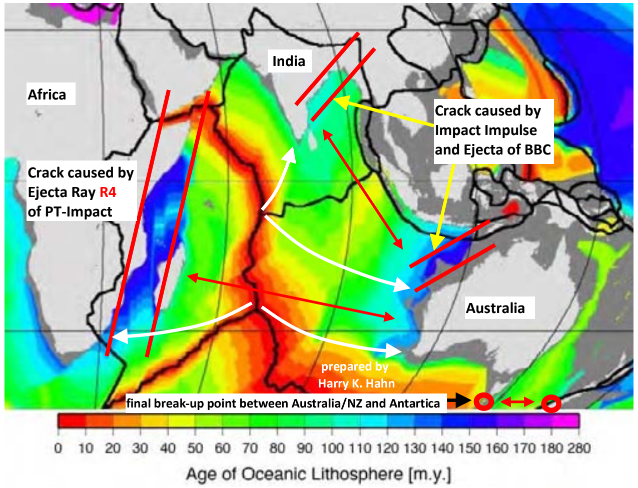
The Gravity Anomaly Map of India shows clear evidence of the described **Ejecta Ray R4**. The precise straight purple-colored signature, which indicates the western border of the Indian Plate, provides a first proof that indeed a powerful ejecta ray has separated India from Africa. And there is further evidence for another powerful ejecta ray which started at the center of the BBC and which formed the NE-border of the Indian Plate. Together with the main impact impulse of the BBC the crack caused by this ejecta ray is responsible for the separation of India from Australia. The ocean age map and the major fracture zones in the ocean floor also confirm this scenario. The age of the Deccan Traps (65.7 to 64.9 Ma ago) contradicts this scenario. But it seems that the **Deccan** flood basalts were caused by a much later violent magma eruption from the crack area caused by the BBC. This Magma eruption and the final break-up of Australia from Antarctica may have been triggered by the Chicxulub Impact.





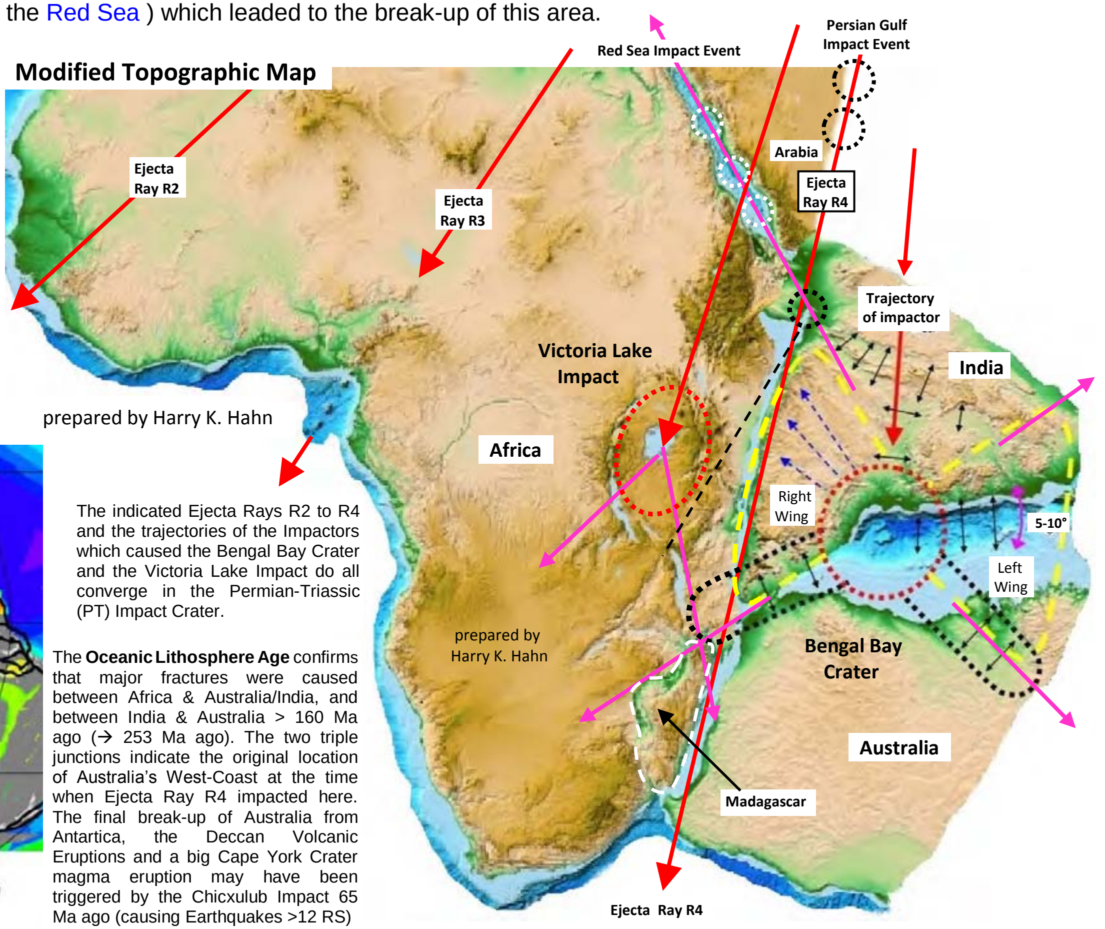
Deccan Trap area selected for an examination
→see this study !





A strong Ejecta Ray (R4) and a large Secondary Impactor caused by the P-T Impact Event leaded to the break-up of India from Africa & Australia (Begin of break-up process : ~ 253 Ma ago) :

This modified Topographic Map shows a probable scenario of the arrangement of these continental plates shortly after the Permian-Triassic (PT) Impact Event. South-America which was still connected to the west-side of Africa, and Antarctica which was still connected to South-Australia and South-Africa at the time of the PT-Impact, are not shown ! Note that the Atlantic Ocean & Southern Ocean, which are partly visible on this map, did not exist at the time of the PT-Impact !
This map shall only demonstrate how Africa, India, Australia and Arabia were arranged to each other, and how this land area of the Super Continent Pangea broke apart, caused by the powerful Ejecta Rays and Secondary Impactors which were ejected from the PT-Impact Crater. Especially the **Ejecta Ray R4** which produced a major crack and the powerful Secondary Impactor which produced the **Bengal Bay Crater (BBC)** are responsible for the break-up of this land area of Pangea. The edges of the ejecta blanket and strong ejecta rays of the BBC caused further cracks in Earth's crust (e.g. between India & Australia, and in the Red Sea) which leaded to the break-up of this area.



The indicated Ejecta Rays R2 to R4 and the trajectories of the Impactors which caused the Bengal Bay Crater and the Victoria Lake Impact do all converge in the Permian-Triassic (PT) Impact Crater.

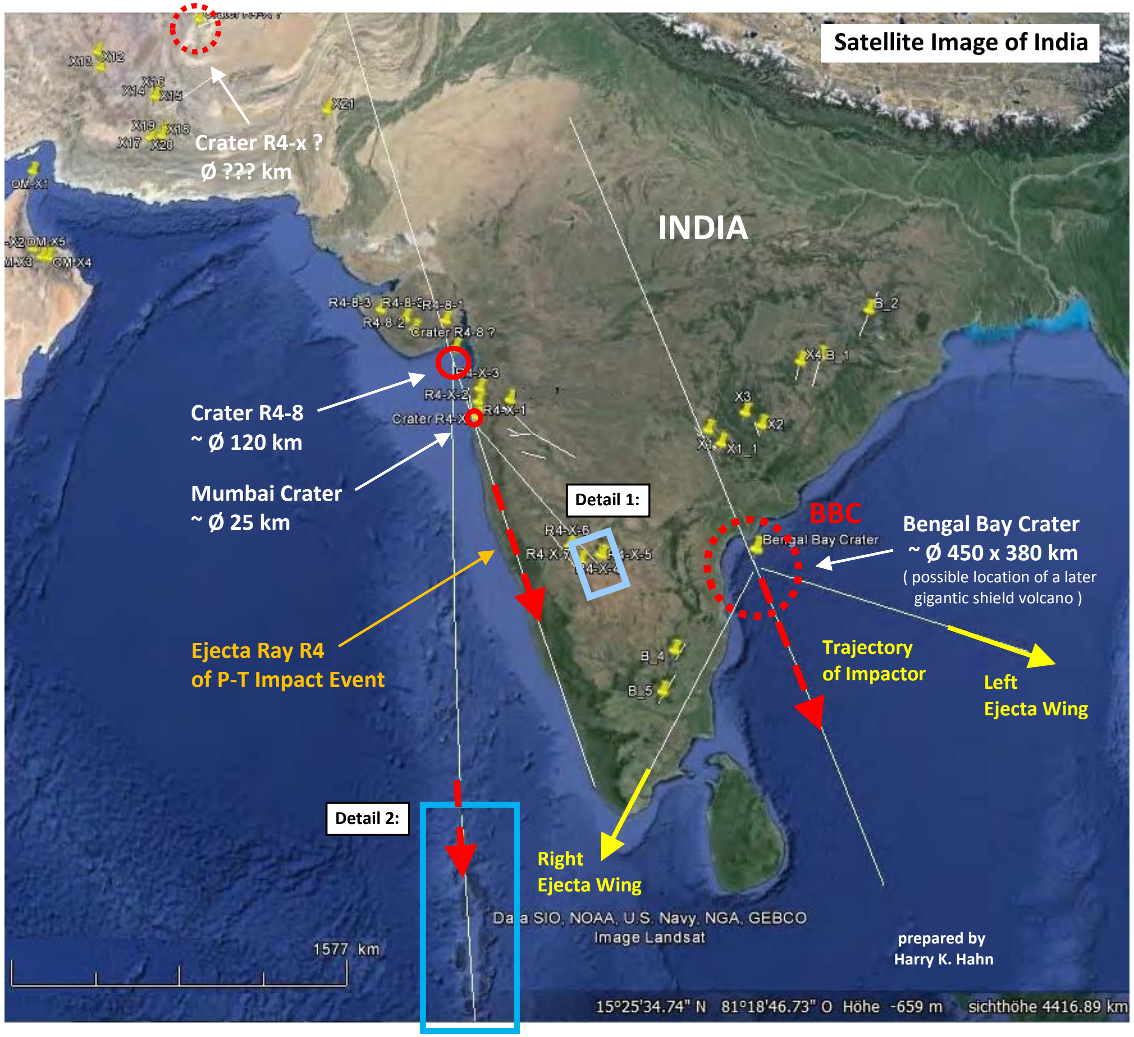
The **Oceanic Lithosphere Age** confirms that major fractures were caused between Africa & Australia/India, and between India & Australia > 160 Ma ago (→ 253 Ma ago). The two triple junctions indicate the original location of Australia's West-Coast at the time when Ejecta Ray R4 impacted here. The final break-up of Australia from Antartica, the Deccan Volcanic Eruptions and a big Cape York Crater magma eruption may have been triggered by the Chicxulub Impact 65 Ma ago (causing Earthquakes >12 RS)

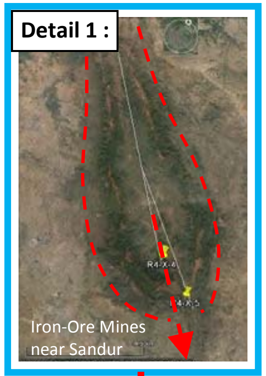
Two craters ∅ ~120 km & ∅ ~25 km on the west-side of the Indian Plate were caused by Ejecta Ray R4 from the PT-Impact

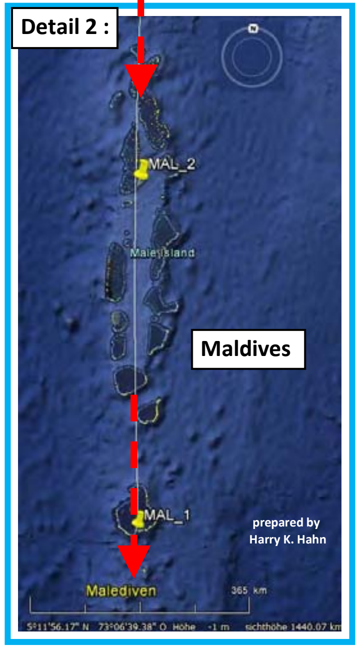
The western border of the Indian Plate was formed by Ejecta Ray R4 of the PT-Impact Event. Secondary Impact Structures along this western border of the Indian Plate indicate the location of two craters which lie on the track of Ejecta Ray R4. The first crater (R4-8) with Ø ~120 km is located on the northern end of the linear western border of the Indian Plate. And the second crater with Ø ~25 km (“Mumbai Crater”) is located around 240 km south of crater R4-8 , directly on the west-coast of India near Mumbai. There is strong indication that the Iron-Ore Deposits around Sandur are ejecta material which is originating in the Mumbai Impact Crater. This is indicated by the orientation and the drop-shape of this Iron-Ore Deposits (Range). → see detailed images of this and other secondary impact structures on the following pages of this document. The Maldives Maldives, a linear island-chain was formed by either ejecta from Crater R4-8 or by Ejecta Ray R4 itself. This is not clear yet. The ejecta ray which formed the Maldives may have drifted away from the Indian Plate later, because of ocean spreading activity.

Another possible impact crater R4-x was probably also located on the track of Ejecta Ray R4 initially, before it moved west-ward through a gigantic mantle flow (in the Pakistan-/ Iran-area) which was caused when the African Plate separated from the Eurasian Plate after the impact of the ejecta from the PT-Impact Event.

A share of the impulse of the Bengal Bay Impact certainly was responsible for the north-ward acceleration of the Indian Plate, which caused the Himalaya when India collided with the Eurasian-Plate. The Deccan Traps probably were caused by a much later violent magma eruption coming from the crack area caused by the BBC. Maybe these flood basalts came from a gigantic shield volcano which collapsed because of earthquakes (>12 RS) triggered by the Chicxulub Impact , 65 Ma ago.



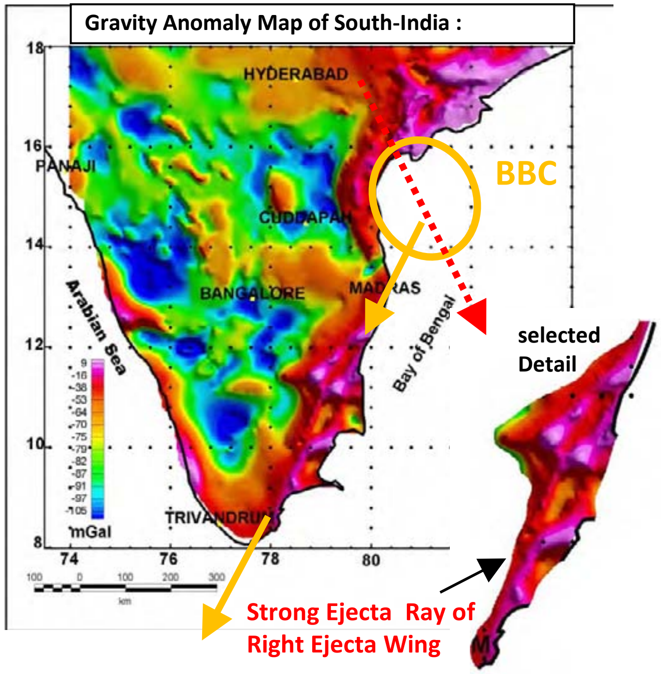


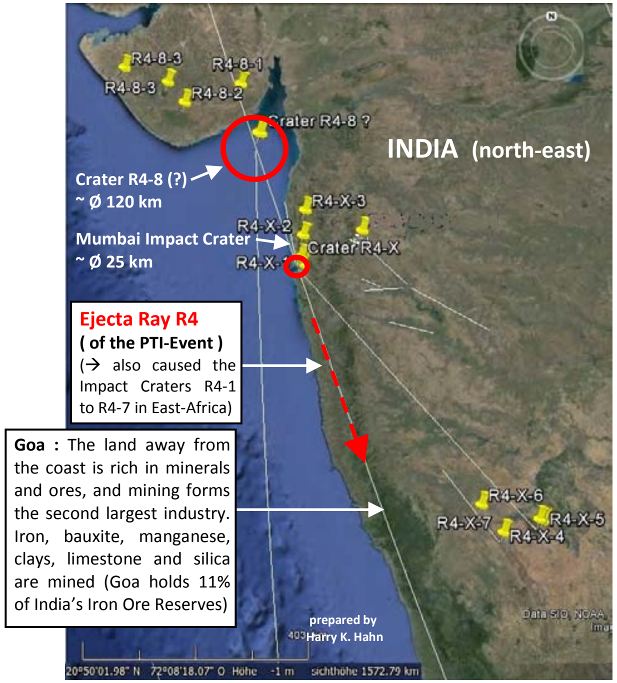


Detail 1 : The Iron-Ore Deposits around Sandur in the Ballari District are ejecta material which is originating in the Mumbai Impact Crater

Detail 2 : The Maldives are the result of a strong ejecta ray from Crater R4-8 or a result of Ejecta Ray R4 itself. This ejecta material may also be rich in Iron-ore & other Metal-Ore. (magnetic anomalies on Maldives)

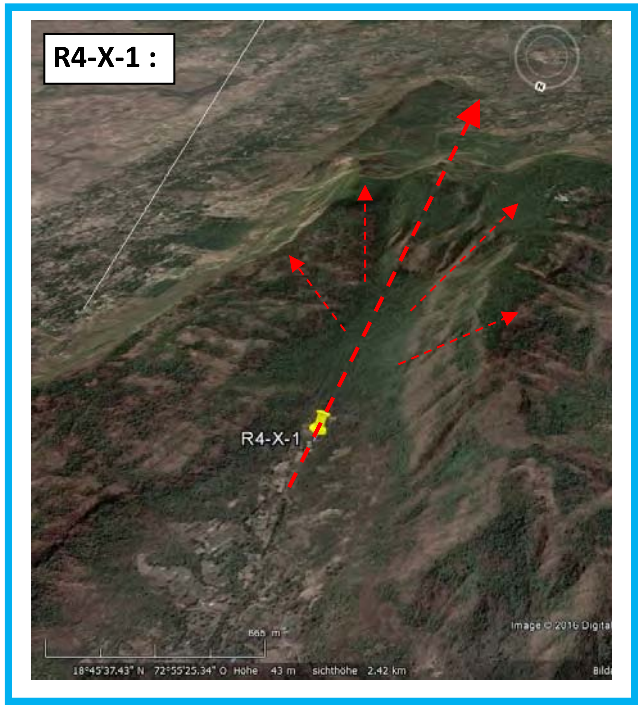
Gravity Anomaly Map of South-India : This map clearly indicates the ejecta ray which formed the south-east border of the Indian Plate. The purple- & red-colored linear structures indicate the ejecta ray (ejecta material) which caused a major crack between the Indian Plate and the Australian Plate 253 Ma ago, which then eventually led to the separation of these two Plates (together with the other much longer crack along the NE-border of the Indian Plate.

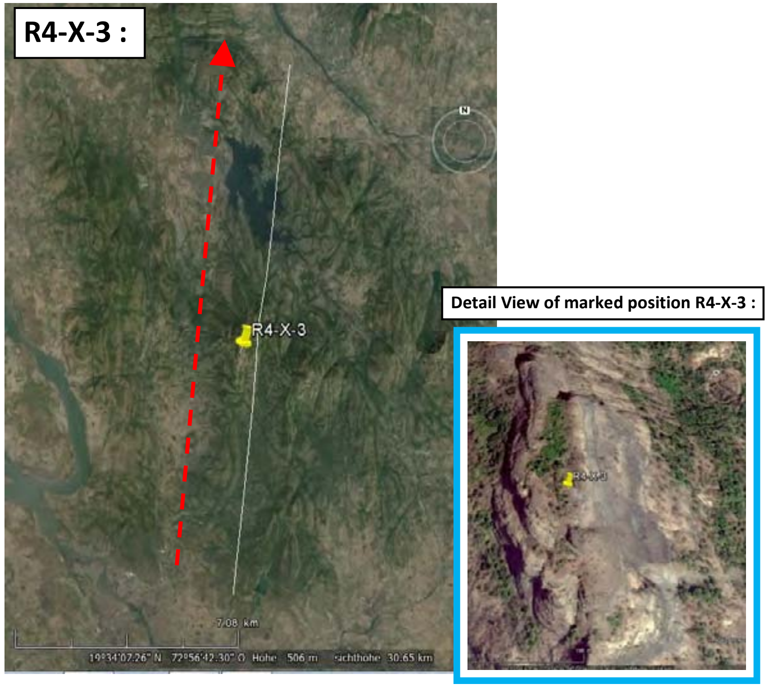




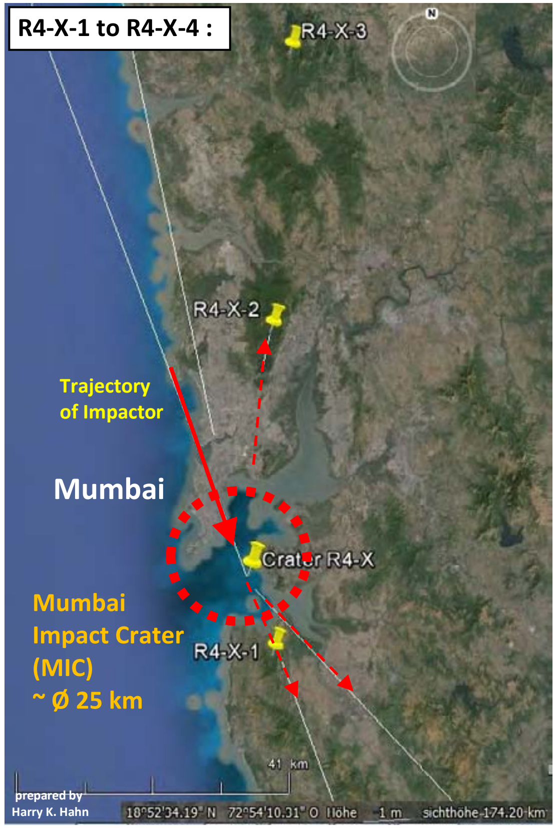
Ejecta Ray R4
(of the PTI-Event)
(→ also caused the Impact Craters R4-1 to R4-7 in East-Africa)

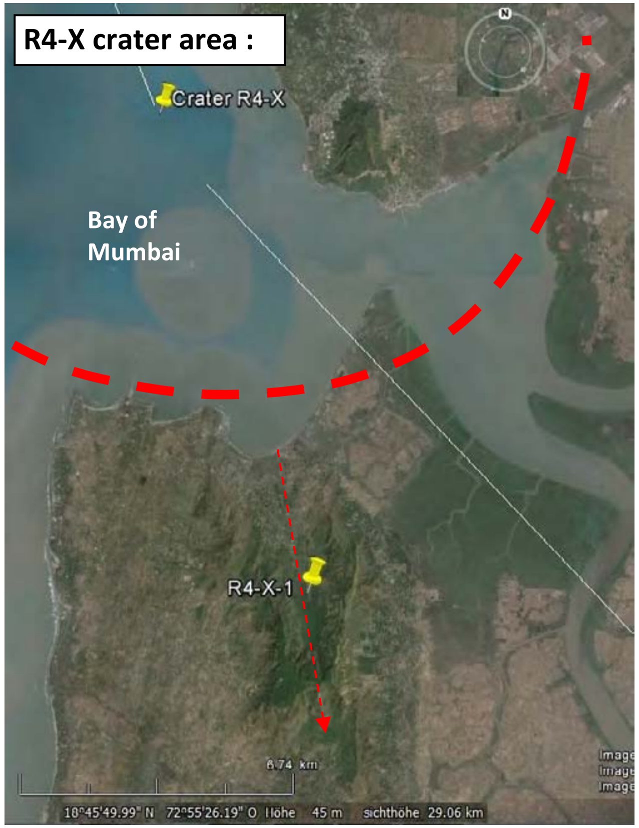
Goa : The land away from the coast is rich in minerals and ores, and mining forms the second largest industry. Iron, bauxite, manganese, clays, limestone and silica are mined (Goa holds 11% of India's Iron Ore Reserves)

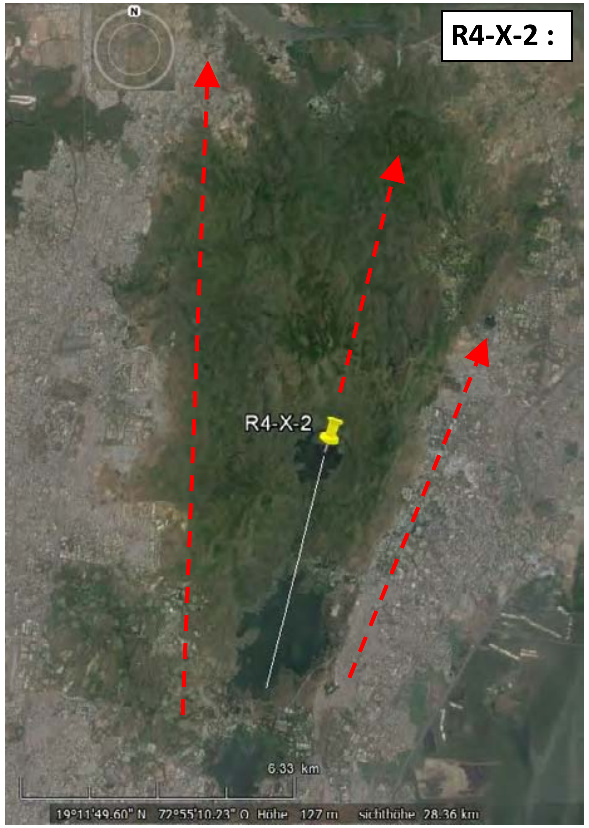

R4-X-1 :


R4-X-3 :

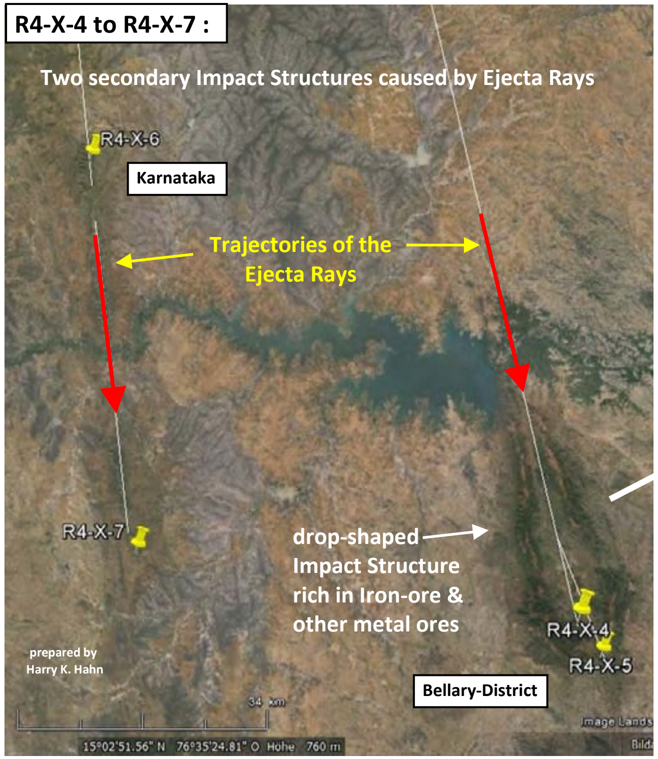
Detail View of marked position R4-X-3 :


R4-X-1 to R4-X-4 :


R4-X crater area :

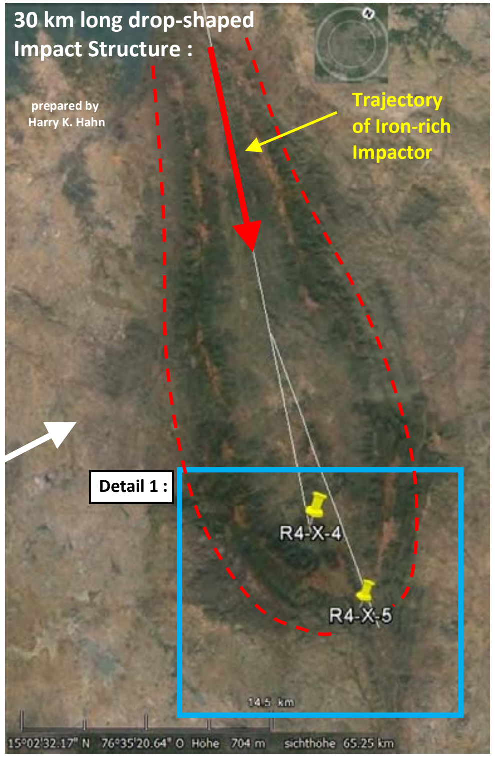

R4-X-2 :

India’s Iron-Ore-Reserves are the result of Secondary Impacts caused by ejecta from the Mumbai Crater, the BBC and the P-T Impact Crater in general

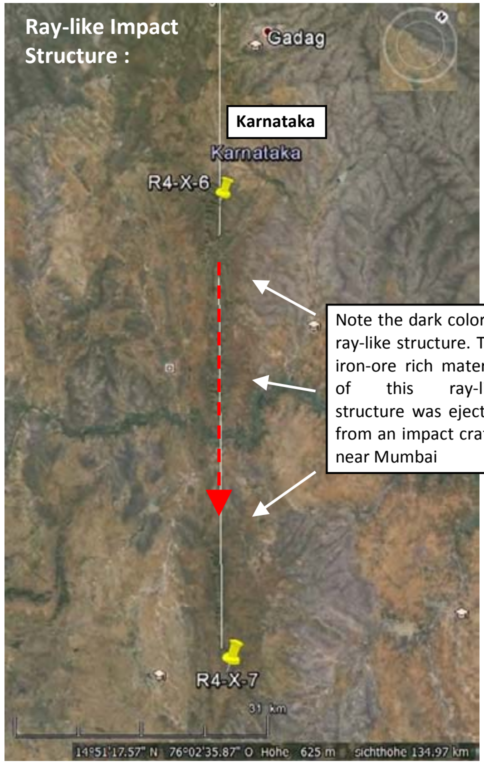

R4-X-4 to R4-X-7 :

Two secondary Impact Structures caused by Ejecta Rays

R4-X-6
Karnataka
Trajectories of the Ejecta Rays
R4-X-7
drop-shaped Impact Structure rich in Iron-ore & other metal ores
R4-X-4
R4-X-5
Bellary-District
prepared by Harry K. Hahn
34 km
15°02'51.56" N 76°35'24.81" O Hohe 760 m

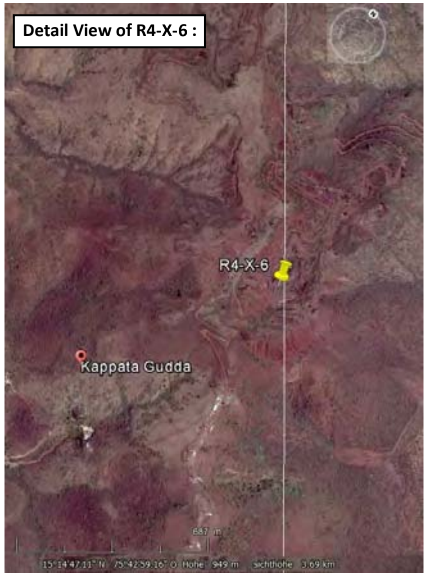

30 km long drop-shaped Impact Structure :

prepared by Harry K. Hahn
Trajectory of Iron-rich Impactor
Detail 1 :
R4-X-4
R4-X-5
14.5 km
15°02'32.17" N 76°35'20.64" O Hohe 704 m sichthohe 65.25 km

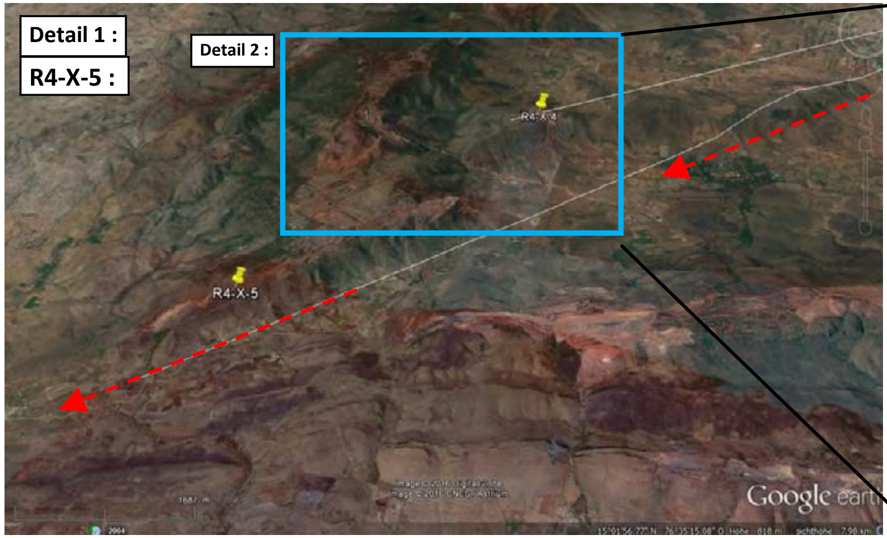

Ray-like Impact Structure :

Note the dark colored ray-like structure. The iron-ore rich material of this ray-like structure was ejected from an impact crater near Mumbai

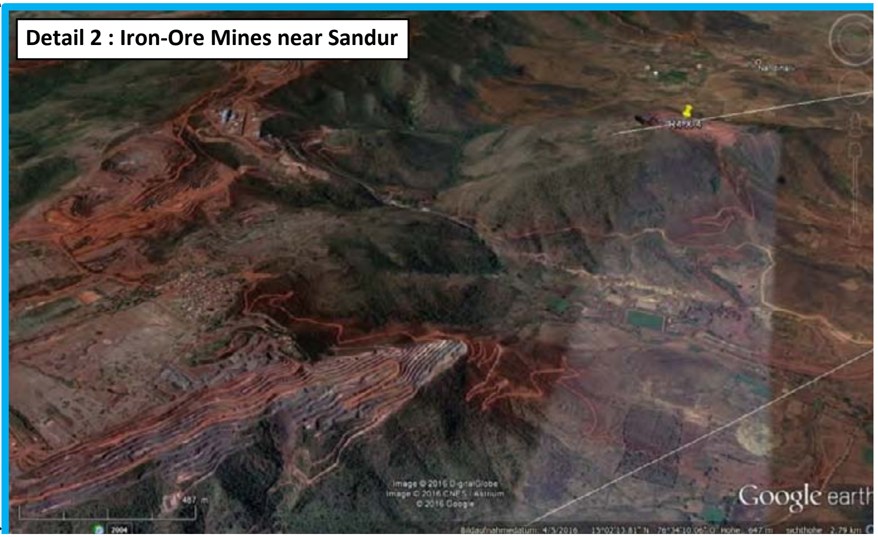
Gadag
Karnataka
Karnataka
R4-X-6
R4-X-7
31 km
14°51'17.57" N 76°02'35.87" O Hohe 625 m sichthohe 134.97 km


Detail View of R4-X-6 :

There is clear indication that the Iron-Ore Deposits near Sandur in the Ballari District are ejecta material which is originating in the Mumbai Impact Crater


Detail 1 :

R4-X-5 :


Detail 2 : Iron-Ore Mines near Sandur

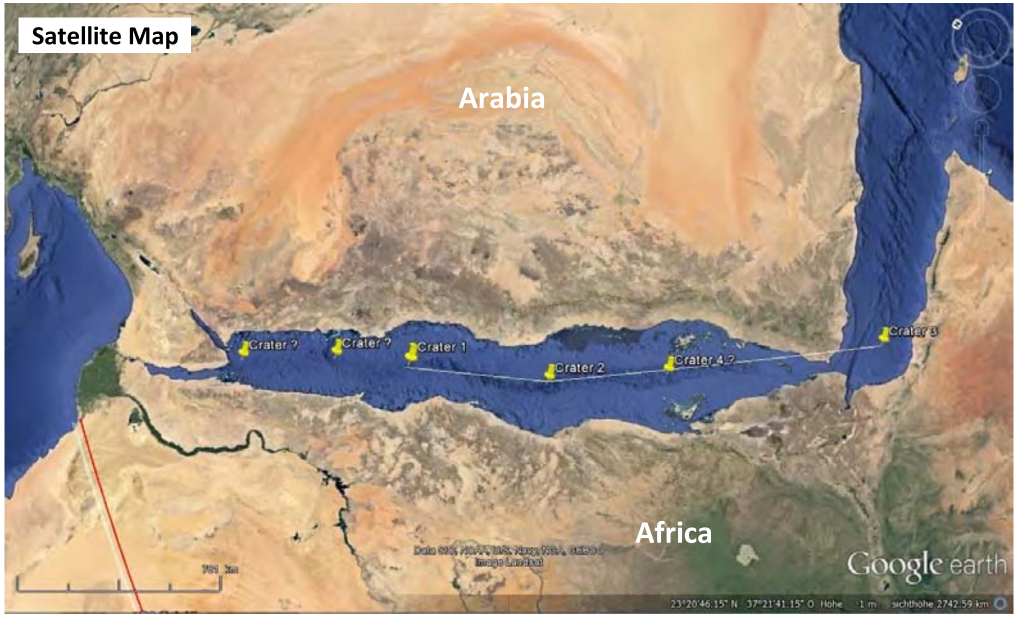
The drop-shape of the mountain range around Sandur (→ iron-ore deposits), its exact orientation and the visible ejecta ray near Gadag lead to the bay near Mumbai.

This leads to the logical conclusion that the bay of Mumbai must be caused by an Impact Crater, which was formed by an iron-rich impactor probably originating from the PT-Impact Event. (this can be concluded from the probable trajectory of the Impactor which caused the Mumbai Impact Crater)

Ballari District is rich in mineral resources. It contains 25% of India's Iron ore reserves. It has both metallic and non-metallic minerals. The metallic minerals include iron ore, manganese ore, redoxide, gold, copper and lead. The non-metallic minerals include andalusite, asbestos, corundum, clay, dolomite, limestone, limekankan, moulding sand, quartz, soap stone, granite and red ochre.

4d The Red Sea “Rift-Area” was caused by an Impact Crater Chain, which was formed by ≥ 3 craters with ø 100 to 150 km

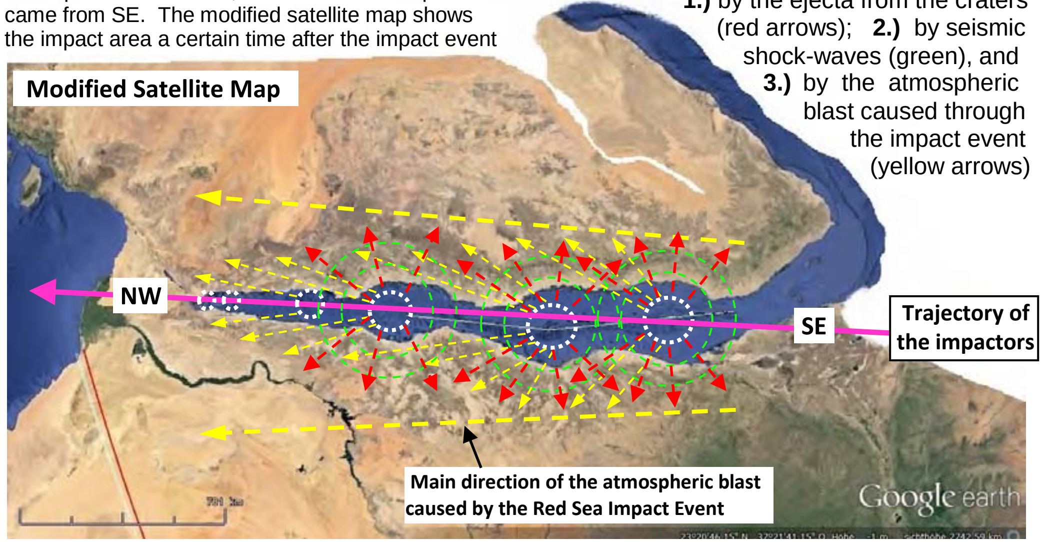
The satellite map and the gravity anomaly map of Africa indicates that the true (initial) cause of the Red Sea Rift-Area was an Impact Event, which in all probability is connected to the PT-Impact Event 253 Ma ago. There are many secondary impact structures visible on the satellite map, along the coast-area east & west of the Red Sea, which indicate that the impactors had a trajectory from the SE to the NW. This means that probably not the PT-Impact itself produced the impactors, but more likely a large secondary impact of the PT-Impact. A probable scenario is shown on the map below. I believe that the Bengal Bay Crater, which in all probability separated India from Australia, has produced these impactors. It seems that the impactors came from the rear edge of the Right Ejecta Wing of the Bengal Bay Impact Event. → I will show some of the secondary impact structures of the Red Sea Rift-area in the document which describes this impact event in more detail.



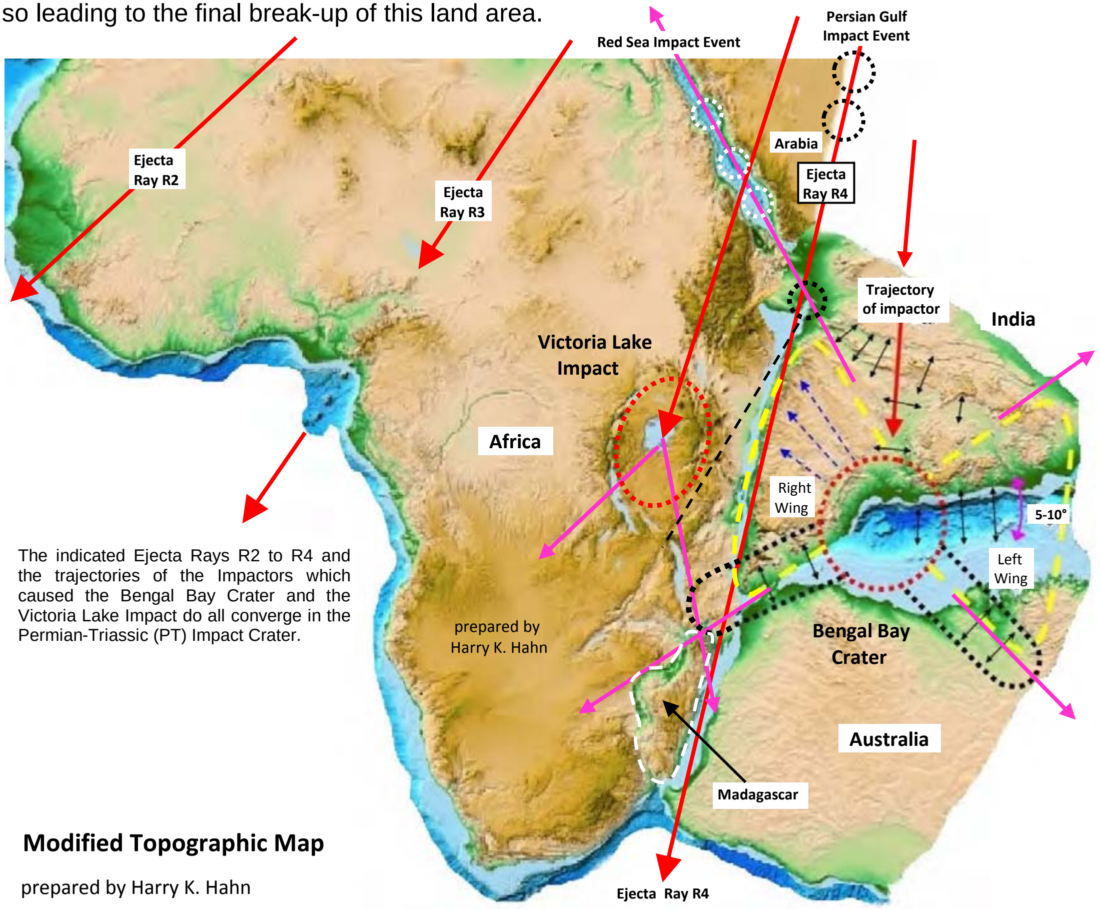
The Red Sea Impact Event occurred from SE to NW

Especially the traces of the atmospheric blast, caused by the Impact Crater Chain, indicate that the impactors came from SE. The modified satellite map shows the impact area a certain time after the impact event

The secondary impact structures were formed by three effects :
1.) by the ejecta from the craters (red arrows); **2.)** by seismic shock-waves (green), and **3.)** by the atmospheric blast caused through the impact event (yellow arrows)


Modified Satellite Map
NW
SE
Trajectory of the impactors
Main direction of the atmospheric blast caused by the Red Sea Impact Event
Google earth

This modified Topographic Map shows a probable scenario of the arrangement of some continental plates shortly after the Permian-Triassic (PT) Impact Event. South-America which was still connected to the west-side of Africa, and Antarctica which was still connected to South-Australia and South-Africa at the time of the PT-Impact, are not shown. And note that the Atlantic Ocean & Southern Ocean, partly visible on this map, did not exist at the time of the PT-Impact !
This map shall only demonstrate how Africa, India, Australia and Arabia were arranged to each other, and how this land area of the Super Continent Pangea broke apart, caused by the powerful Ejecta Rays and Secondary Impactors which were ejected from the PT-Impact Crater. Especially the Ejecta Ray R4 which produced a major crack and the powerful Secondary Impactor which produced the Bengal Bay Crater (BBC) are responsible for the break-up of this land area. The edges of the ejecta blanket of the BBC caused further cracks in Earth’s crust (e.g. the Red Sea) also leading to the final break-up of this land area.



The indicated Ejecta Rays R2 to R4 and the trajectories of the Impactors which caused the Bengal Bay Crater and the Victoria Lake Impact do all converge in the Permian-Triassic (PT) Impact Crater.

Modified Topographic Map

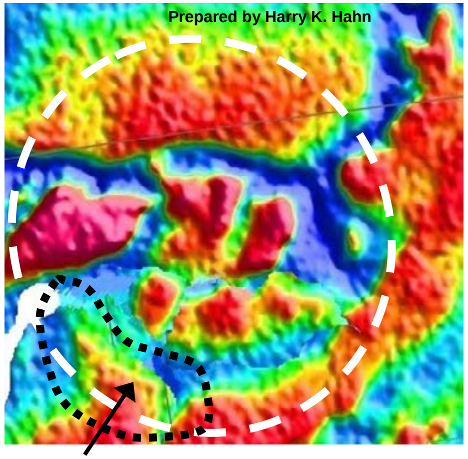
prepared by Harry K. Hahn

5 Oblique Impact Crater with ∅ 400 x 350 km in the North-West of Western Australia. Expected age ~ 253 Ma.

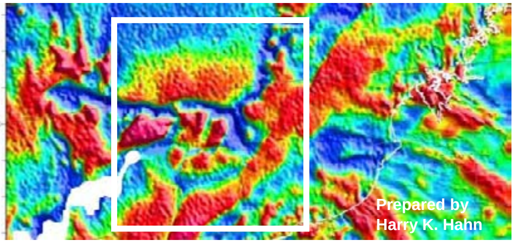
Prepared by Harry K. Hahn

The gravity anomaly map of Australia shows evidence for another large impact crater near Port Hedland, which has an elliptical shape. It's an oblique impact crater, which means that the impactor arrived in a shallow angle of probably < 30° The impactor had a diameter of approx. 20 to 50 km and was probably a fragment of the main impactor which caused the mass extinction at the Permian-Triassic boundary 253 million years ago. Because it was an oblique impact it produced a butterfly ejecta blanket. I have marked the two wings of the ejecta blanket with yellow dotted lines on the maps Along the center lines of these ejecta wings big cracks in Earth's crust opened up. Here a majority of the ejecta mass impacted on the surface. However there were also some thin forward ejecta rays thrown out of this impact crater. They are marked with white & purple lines on the gravity anomaly map. A few strong rays of these ejecta rays cut-off Australia from Pangea. One of the main mining sites for the Platin-Group Elements (in Kalgoorlie) is located where some of these ejecta rays impacted.

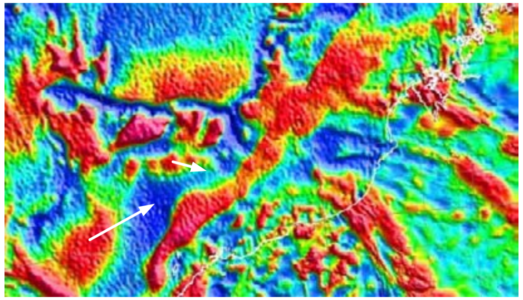
Elliptical Impact Crater ∅ 400 x 350



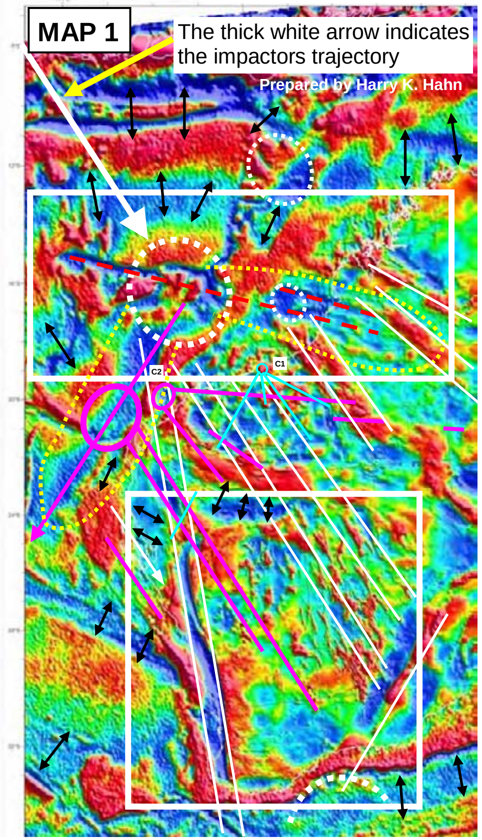
Note the precise crater-wall shape on the marked fragment !!

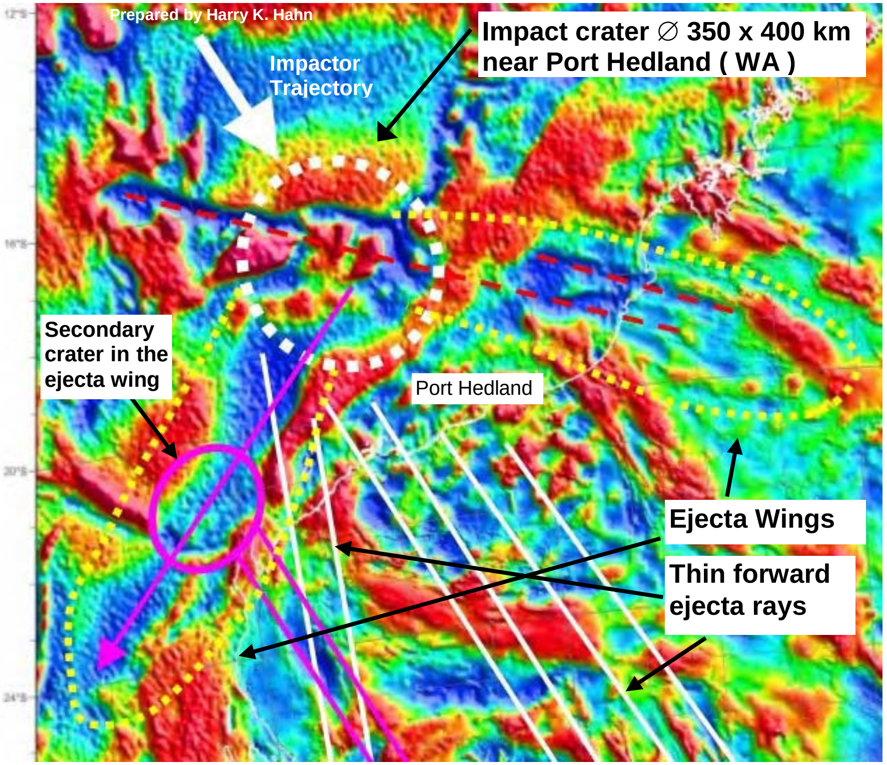


This image is manipulated and shows the crater roughly in it's original state



Here for comparison the original map


MAP 1
The thick white arrow indicates the impactors trajectory
Prepared by Harry K. Hahn
C1
C2


Prepared by Harry K. Hahn
Impactor Trajectory
Impact crater ∅ 350 x 400 km near Port Hedland (WA)
Secondary crater in the ejecta wing
Port Hedland
Ejecta Wings
Thin forward ejecta rays
12°S
16°S
20°S
24°S

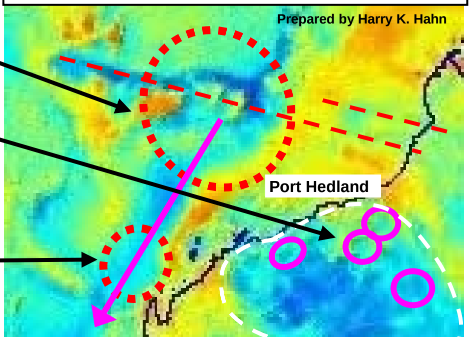
GRAVITY ANOMALY MAP OF THE AUSTRALIAN REGION
3RD EDITION, 2008
GeoCat No [illegible]
Geoscience Australia
GPO Box 378
Canberra, ACT 2601

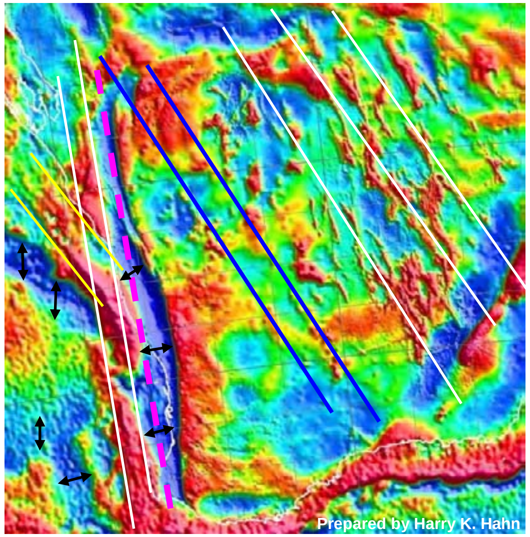
Other gravity anomaly map :

Elliptical Impact crater with central uplift visible

Note that there are many smaller impact craters are visible on the Pilbara Craton. But these are other mostly very old impact craters ! (> 3 Ga !)

Secondary Impact within the right ejecta wing



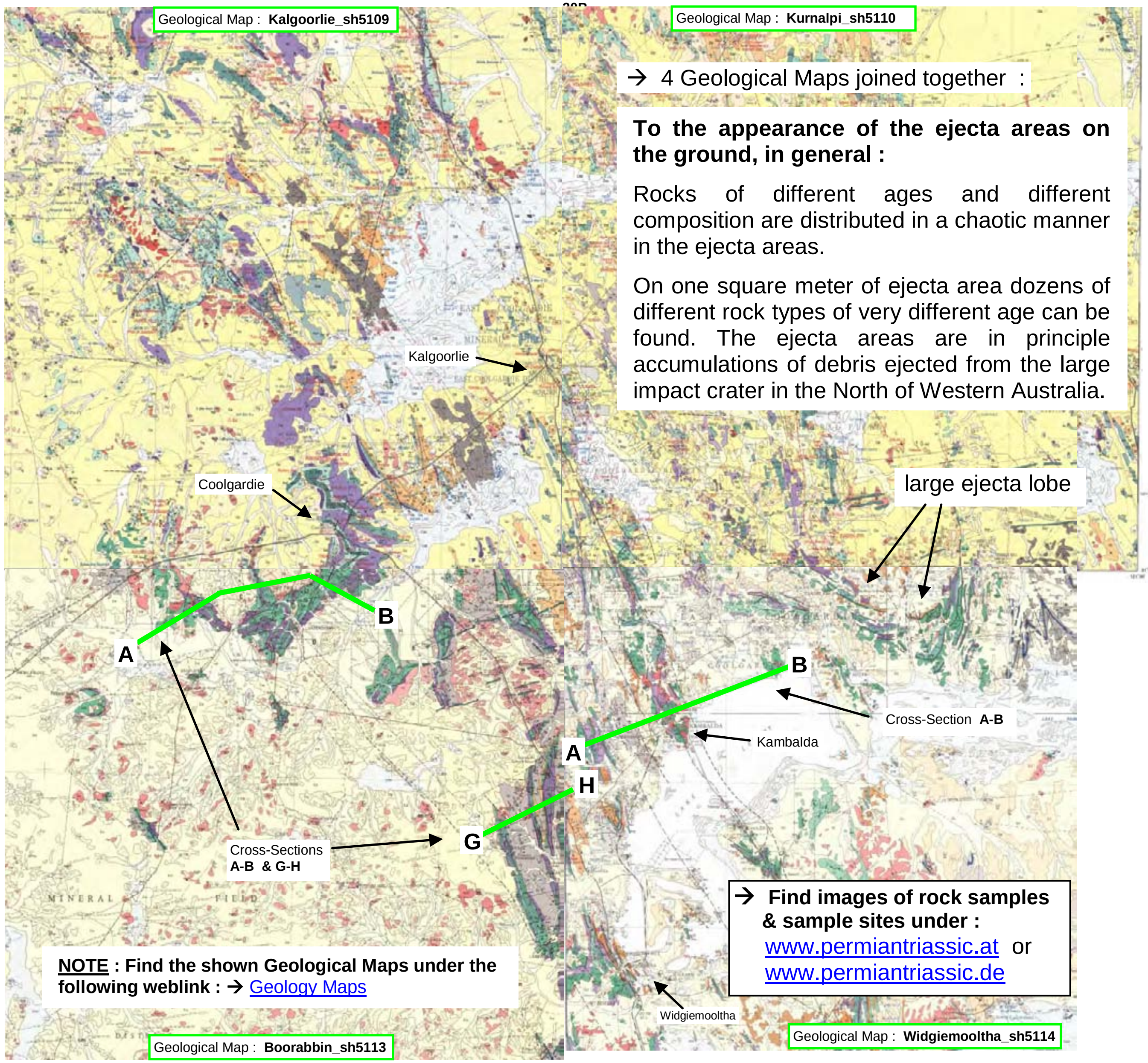


The left image shows that there is a smaller secondary elliptical structure within the right ejecta wing, from which further ejecta rays originate. The right image shows on the left side the strong ejecta rays which cut-off the Yilgarn Craton from Super-Continent Pangea.

To the appearance of the ejecta rays, from the large impact crater in the NW, on the geological maps :

Prepared by Harry K. Hahn

The following image shows the area around Kalgoorlie, where a considerable share of the forward ejecta material impacted on the Yilgarn Craton. The geological map indicates that that the stripe-shaped (linear) formations and the lobe-shaped formations with high probability are ejecta lobes and ejecta rays which originate from the large impact crater in the NW of Western Australia. And it is no coincidence that many Mines for Platinum Group Elements are located in close proximity to these ray-shaped and lobe-shaped geological formations.. One of the biggest Gold Mines of the world is located in Kalgoorlie, close to one of this ejecta rays.


Geological Map : Kalgoorlie_sh5109
Geological Map : Kurnalpi_sh5110
Kalgoorlie
Coolgardie
large ejecta lobe
B
A
B
Cross-Section A-B
Kambalda
A
H
G
Cross-Sections A-B & G-H
Widgiemooltha
Geological Map : Boorabbin_sh5113
Geological Map : Widgiemooltha_sh5114

→ 4 Geological Maps joined together :

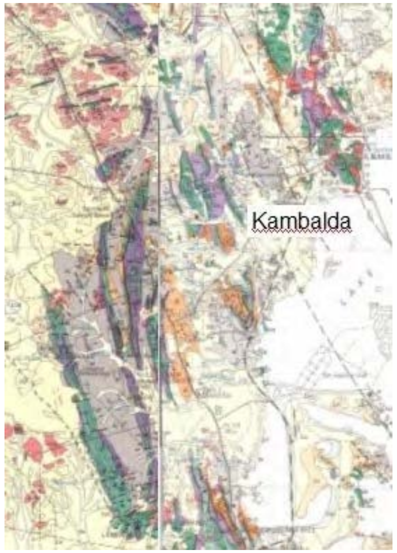
To the appearance of the ejecta areas on the ground, in general :

Rocks of different ages and different composition are distributed in a chaotic manner in the ejecta areas.

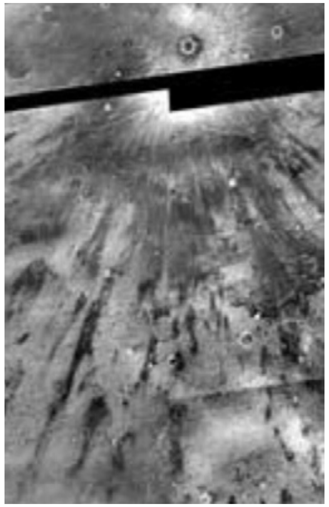
On one square meter of ejecta area dozens of different rock types of very different age can be found. The ejecta areas are in principle accumulations of debris ejected from the large impact crater in the North of Western Australia.

→ Find images of rock samples & sample sites under :
www.permiantriassic.at or
www.permiantriassic.de

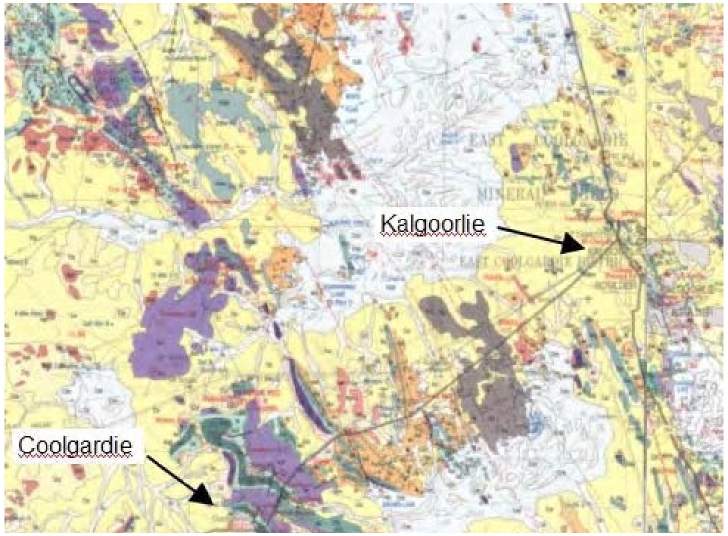
NOTE : Find the shown Geological Maps under the following weblink : → Geology Maps



Ejecta lobes near Kambalda



Graterri Crater **on Mars :**
Compare the shape of the ejecta lobes and rays !

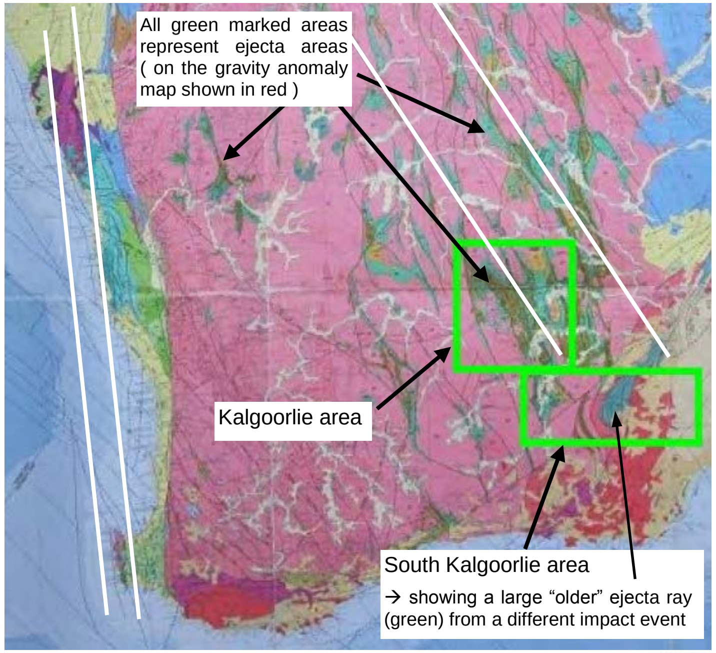


Ejecta lobes & rays near Kalgoorlie & Coolgardie

How the massive ejecta rays, originating from the large impact crater in the NW, appear underground :

The ejecta rays visible on the gravity anomaly map of Australia, which were ejected from of the large crater north of the North-West Coast of Western Australia, were examined in many geological surveys. Here they show up in the geological cross sections on the maps, as parabola-shaped rock formations (intrusions) in the base rock of the Yilgarn Craton. These ejecta rays cut into the rock around **5 to 15 km deep**.
A strong ray along the west coast even cut-off the Yilgarn Craton.

Prepared by Harry K. Hahn



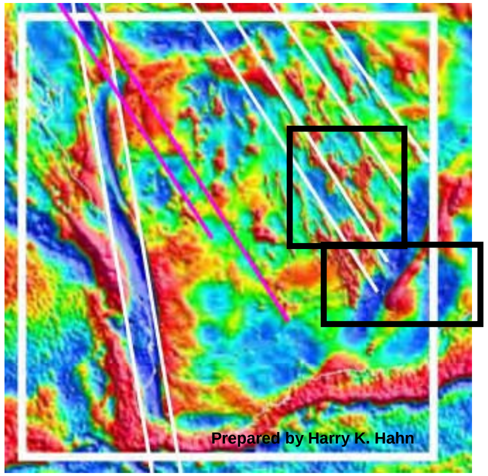
All green marked areas represent ejecta areas (on the gravity anomaly map shown in red)

Kalgoorlie area

South Kalgoorlie area
→ showing a large "older" ejecta ray (green) from a different impact event

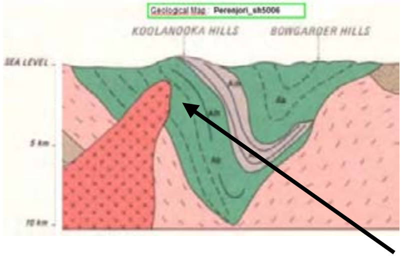
Geological Map of Western Australia

Compare with Gravity Anomaly Map :



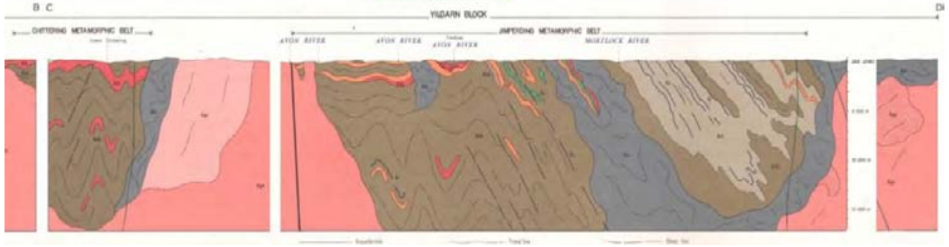
Geraldton area :

Cross-Section B-C
Geological Map Perenjori_sh5006



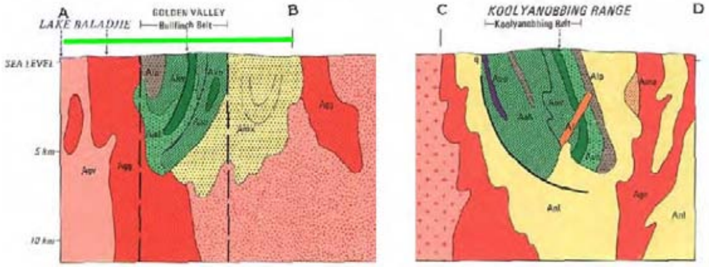
Note how this ejecta ray (green layers) got deformed by the red marked rock formation

Cross-Section C-D
Geological Map Perth_sh5014

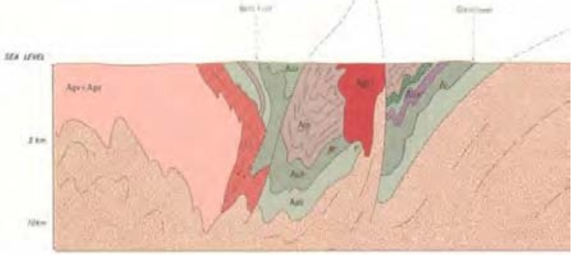


Southern Cross area :

Cross-Section **A-D** Geological Map : **Jackson_sh5012**

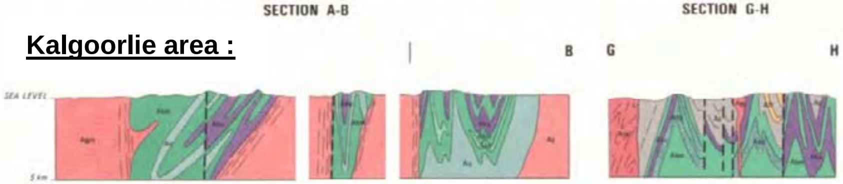


Cross-Section **A-C** Geological Map : **Southern Cross_sh5016**

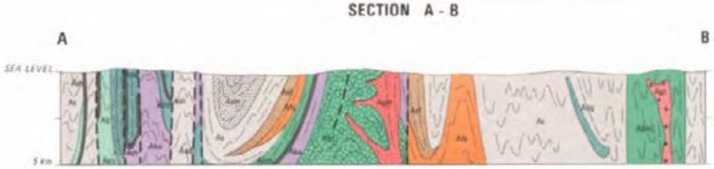


Kalgoorlie area :

Cross-Sections from : Geological Map : **Boorabbin_sh5113**



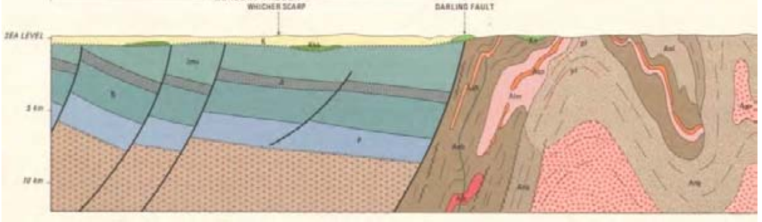
Cross-Section from : Geological Map : **Widgiemooltha_sh5114**



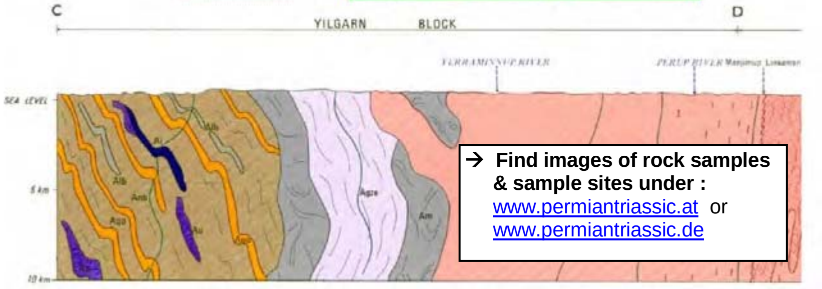
Margaret River area :
(SW corner of WA)

NOTE : Find the shown Geological Maps under the following weblink : → Geology Maps

Cross-Section **A-B (3)** Geological Map : **Collie_si5006**



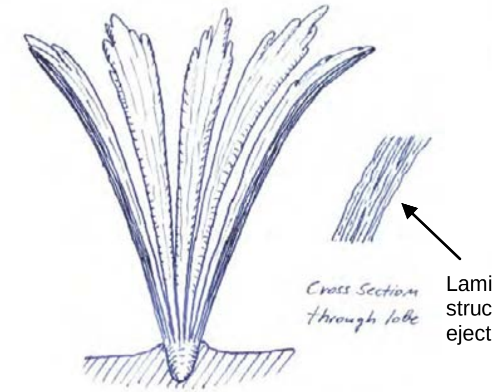
Cross-Section **C-D** Geological Map : **Pemberton Irwin Inlet_si5010**

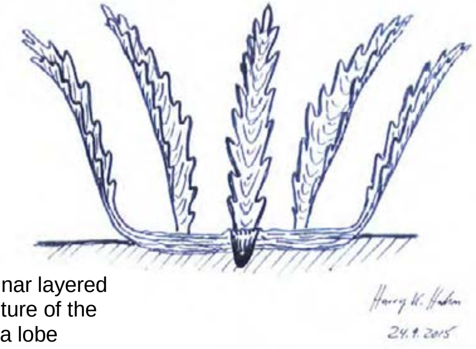


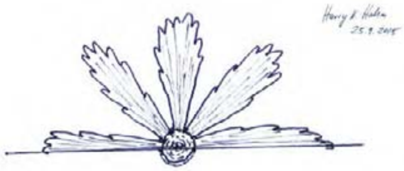
→ Find images of rock samples & sample sites under :
www.permiantriassic.at or
www.permiantriassic.de

Parabola shaped geol. intrusions caused by ejecta rays

The following images shall demonstrate how ejecta rays have formed the deep parabola shaped intrusions (rock formations). Especially ejecta material which contains ductile material like iron, will form laminar sheet-like ejecta lobes, with many laminar layers, which includes other material too On a planet with a dense atmosphere, like on Earth, these laminar sheet-like ejecta lobes will then take on the form of an U-shaped lobe before impacting on the ground, because of the strong airflow on the outside of the ejecta lobe. When impacting on the ground this ductile ejecta lobes will form the parabola shaped intrusions as described on the previous pages.

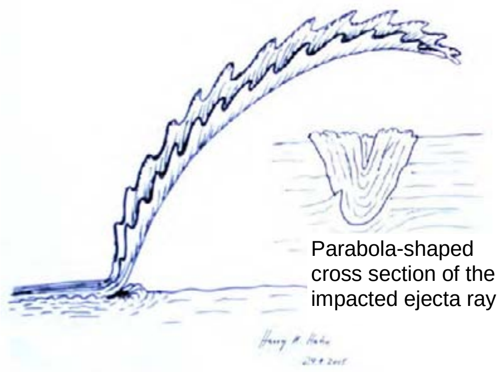

Cross Section through lobe
Laminar layered structure of the ejecta lobe





Ejecta lobes directly after impact

a certain time after impact


Parabola-shaped cross section of the impacted ejecta ray
Harry K. Hahn
24.9.2015

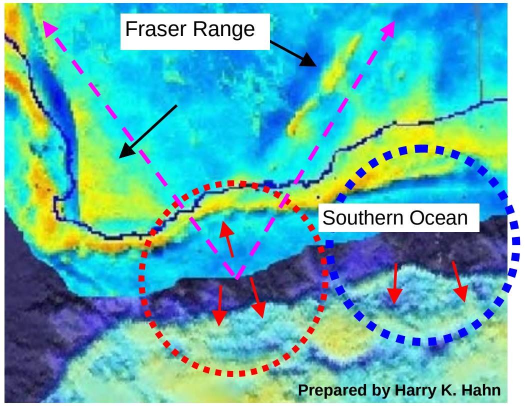
because of aero-dynamic reasons the lobe takes on an U-shaped cross-section

Example of a sample site in WA which shows the described laminar iron-bearing rock which was ejected from the big impact crater in the North. It is from the Southern Cross area; Location : 30”47,882 S : 118”59,477 E . It seems that the whole linear mountain range is made of this laminar ejecta lobe which is orientated vertically.

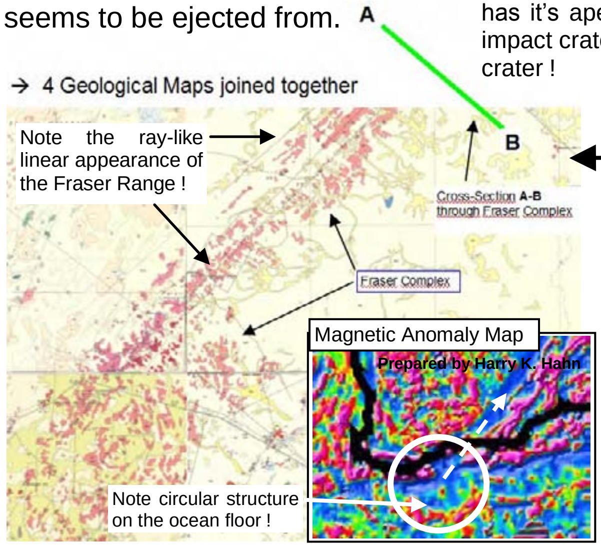
See Cross Section A-B
Southern Cross area
→(Golden Valley)

Evidence of another ejecta ray structure south of Kalgoorlie
This ejecta ray structure is also at least 253 Ma , or older :

The geological map of the area south of Kalgoorlie already indicates a suspious linar geological structure, the FRASER RANGE. Rock samples from the center line of the mountain range show large amounts of mineral glass (diaplectic glass) which is a strong indicator for an impact origin. Further indication gives a map combination of a gravity anomaly map of Australia and a topographic map of Antartica, arranged to each other so as they were ~200 Ma ago (at Pangea time). The image indicates a **420 km crater** from which the large ejecta ray (the Fraser range) seems to be ejected from.

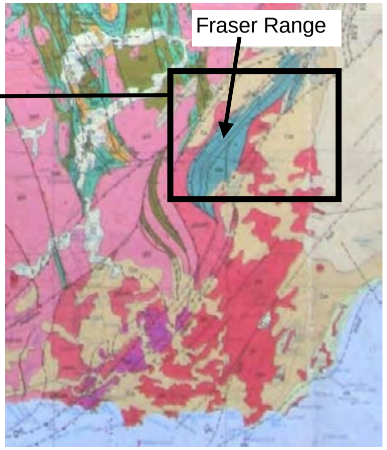


Note the ring structures, the strong ejecta ray and the cone shaped gravity anomaly which has it’s apex in the center of the red marked impact crater. And there is obviously another crater !

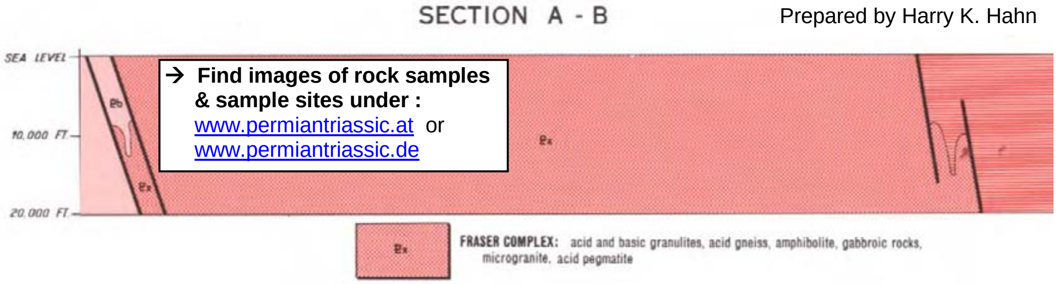

A
→ 4 Geological Maps joined together
B
Cross-Section A-B through Fraser Complex
Fraser Complex
Magnetic Anomaly Map
Prepared by Harry K. Hahn

Note the ray-like linear appearance of the Fraser Range !

Note circular structure on the ocean floor !



Cross-Section from : Geological Map : **Zanthus_sh5115**


SECTION A - B
SEA LEVEL
10,000 FT
20,000 FT
Єb
Єx
Єx
FRASER COMPLEX: acid and basic granulites, acid gneiss, amphibolite, gabbroic rocks, microgranite, acid pegmatite

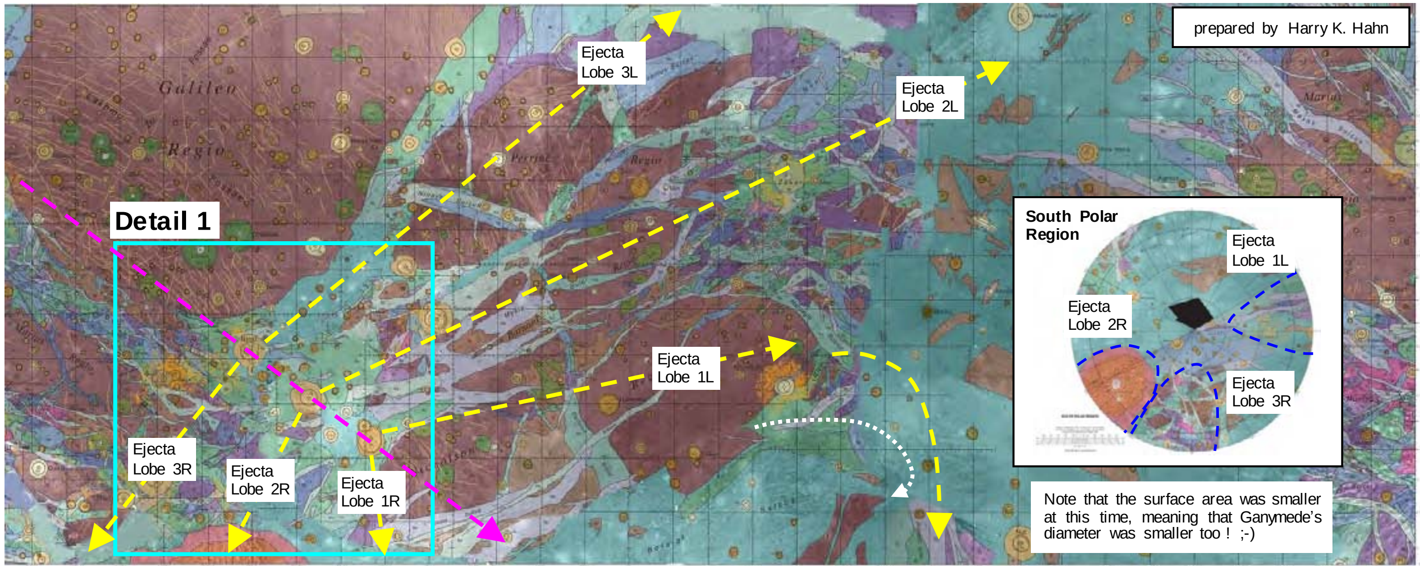
Prepared by Harry K. Hahn

→ Find images of rock samples & sample sites under :
www.permiantriassic.at or
www.permiantriassic.de

6 Global Expansion Tectonics on Jupiter's Moon Ganymede caused by a global impact event with several impactors

Jupiter moon Ganymede shows Expansion Tectonics over it's whole surface area. Looking on Ganymede's geological map then it is very obvious that the brown colored areas represent fragments of a sphere which are slowly drifting away from each other. It is undeniable that this moon is in expansion mode and the fragments of the older smaller spherical surface get slowly pulled away from each other through an expanding mantle underneath ! Having a closer look at the distribution pattern of the fragments, than it becomes clear that a global impact event must have triggered the shattering of the former spherical shell (or crust) and the mantle expansion of Ganymede. This impact event was caused by several impactors , probably the fragments of an asteroid or comet. At least 3 big impacts produced a global ejecta blanket.

Satellite Image



prepared by Harry K. Hahn

Note that the surface area was smaller at this time, meaning that Ganymede's diameter was smaller too ! ;-)

Image 1 : Manipulated Geological Map, showing roughly how the impact scene looked many million years in the past

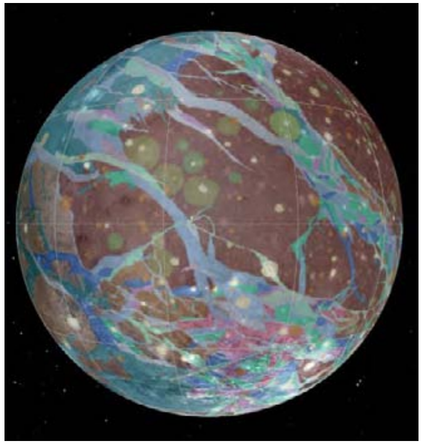
Near-infrared & UV-spectral analysis

Water ice seems to be everywhere on the surface !!, with a mass fraction of 50–90%, significantly more than in Ganymede as a whole. Strong water-ice absorption bands present. The analysis of near-infrared and UV-spectra has also revealed the presence of carbon dioxide, sulfur dioxide, cyanogen, hydrogen sulfate and various organic compounds. And there are the salts magnesium sulfate ($MgSO_4$) and sodium sulfat present on the surface.

Interesting Weblinks :

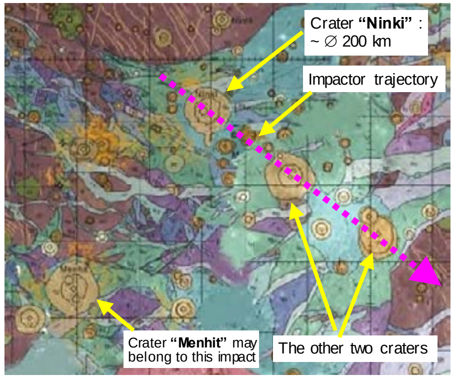
Ganymede Geology:
Ganymede Geology

Rotating Geological Map :
GEO Animation ,
Rotation Animation 2



Global Geologic Map : "A shattered sphere"

Detail 1 : Shows the main impacts which are probably responsible for the Expansion Tectonics. The biggest is crater Ninki with ~ ∅ 200 km. The other craters in the row are > ∅ 150 km each



Crater **"Ninki"** : ~ ∅ 200 km

Impactor trajectory

Crater **"Menhit"** may belong to this impact

The other two craters

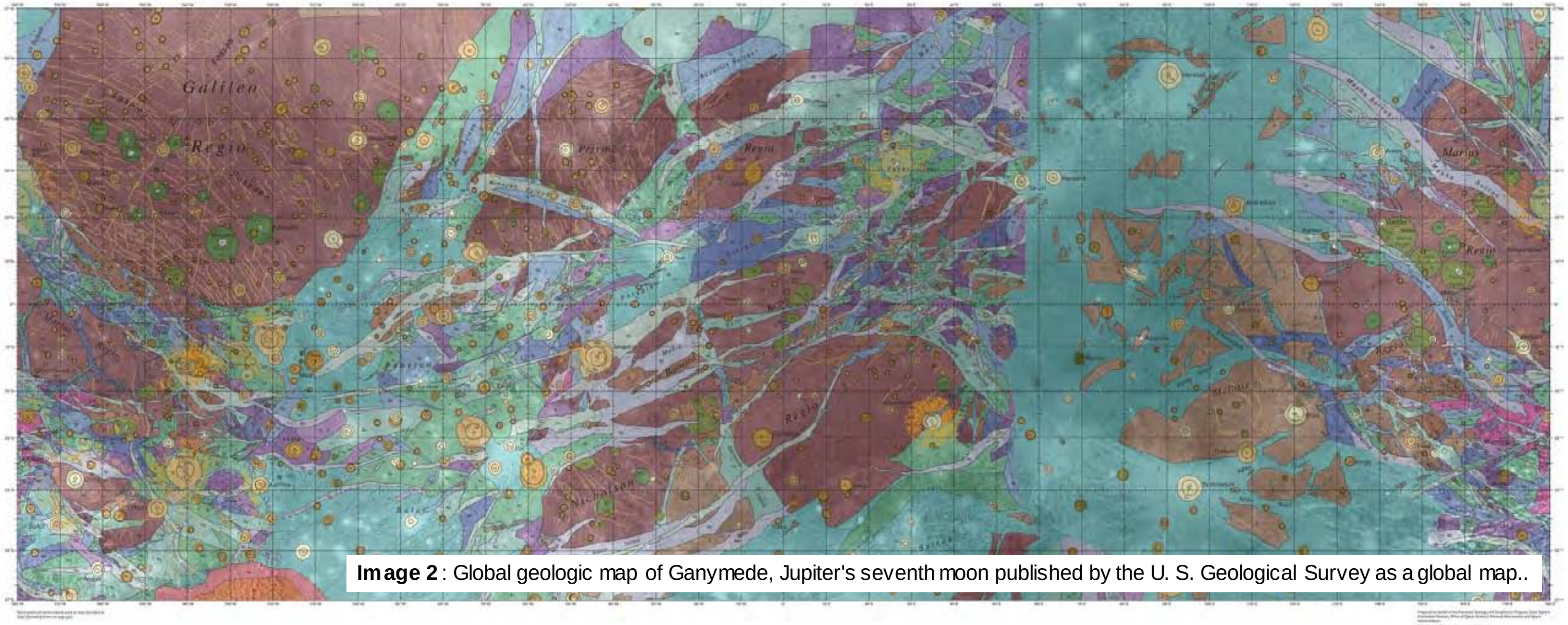


Image 2 : Global geologic map of Ganymede, Jupiter's seventh moon published by the U. S. Geological Survey as a global map..

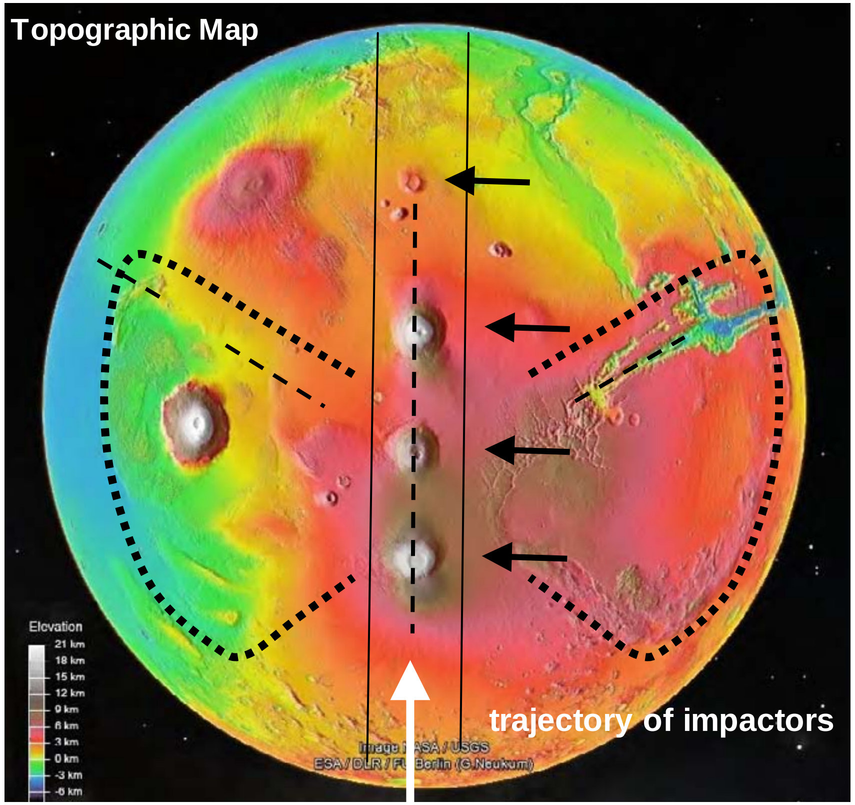
7

A global impact event occurred on Mars probably less than 250 Ma ago which produced at least 4 large impact craters of up to 600 km diameter which fractured Mars' crust and led to global expansion tectonics.

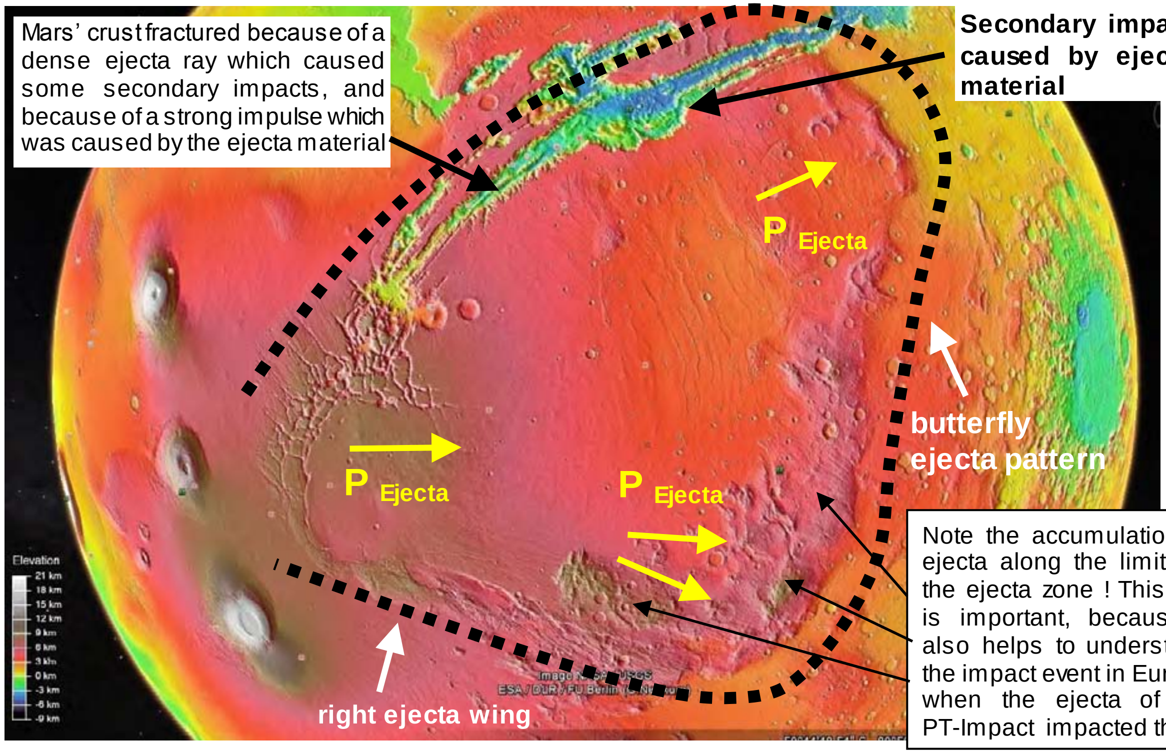
The dichotomy on Mars, extreme volcanism and the ancient oceans & water erosion on Mars are a direct result of the impact event The water which formed the oceans on Mars was brought to the surface in the process of the global expansion tectonics and the extreme volcanism which followed the impact event, and which was going on for millions of years.

The impactors which produced the impact craters had a diameter in the range of 20 to 50 km each.

The impact was an oblique impact which means that the impactors arrived in a shallow impact angle probably < 30° in regards to the surface. This is indicated by the ejecta pattern of the impact. The following images will give a first explanation of the impact event :



This image clearly shows that the shield volcanos of the Tharsis Montes region are the result of a global impact event. There is fourth smaller shield volcano which lies a bit further up. All four structures lie on one precise line ! This is strong indication for an impact event, because impactors of a collapsed comet or asteroid always arrive on one straight line because they share a common orbit.



Mars' crust fractured because of a dense ejecta ray which caused some secondary impacts, and because of a strong impulse which was caused by the ejecta material

Secondary impact caused by ejecta material

Note the accumulation of ejecta along the limits of the ejecta zone ! This fact is important, because it also helps to understand the impact event in Europe when the ejecta of the PT-Impact impacted there

This image shows a classical butterfly-shaped ejecta pattern on the righthand side of the impactor chain. From the shape of the ejecta pattern the trajectory of the impactors becomes obvious, because a butterfly-ejecta pattern is always wider in the direction in which the impactor travelled before impact → **see introduction**

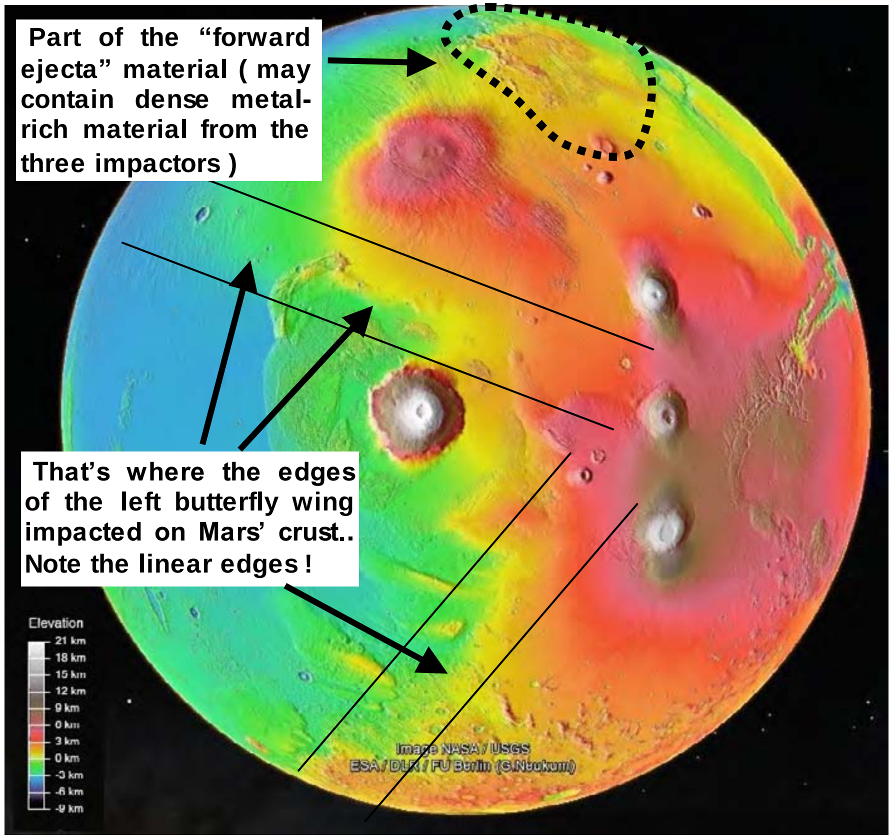
Regarding the accumulation of the ejecta material the following can be concluded : Because of the nearly simultaneous impact of the three main impactors there were three spherical shock waves developing around the three craters. And along the nearly plane meeting zones of the shock waves the ejecta was forced to accumulate along straight lines : → **see example of double & triple impact in the introduction !**

The dichotomy on Mars → the clear difference in the topography between the northern and southern hemisphere of Mars, and the formation of the large ocean basins Utopia Planitia & Arcadia Planitia is a direct result of this global impact event !

Because there was strong expansion tectonics going on, which was triggered by the global impact event, the area which is marked in blue on the map (→ deepest area !) is mainly new (additional) surface area of the planet !! Please compare this global impact event on Mars with the one on the Jupiter moon Ganymede (see study !). Both impact events are very similar !

The left side of the butterfly-shaped ejecta pattern (→ the left wing) caused straight fractures in the crust of Mars, similar as it happened on the right side, caused by the right wing of the ejecta, were the impact impulse of the ejecta and secondary craters fractured the crust in a straight line and caused the gigantic Valles Marineris Canyon, which stretches over a distance of 2400 km !

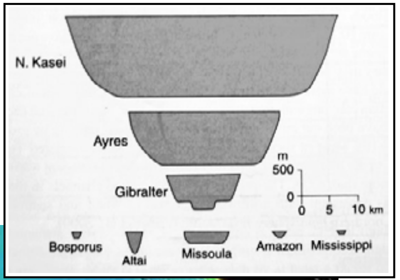
It is also easy visible that large amounts of water came from the Valles Marineris Region ! Which means that the water came from the interior of the planet ! It was water which was contained in the magma, probably in a super-saturated state. And when the planetary crust fractured it was released because of the rapid drop of pressure in the uncovered (fractured) mantle regions. The maximum filling of the ocean basins probably happened when the expansion tectonics was in full swing.



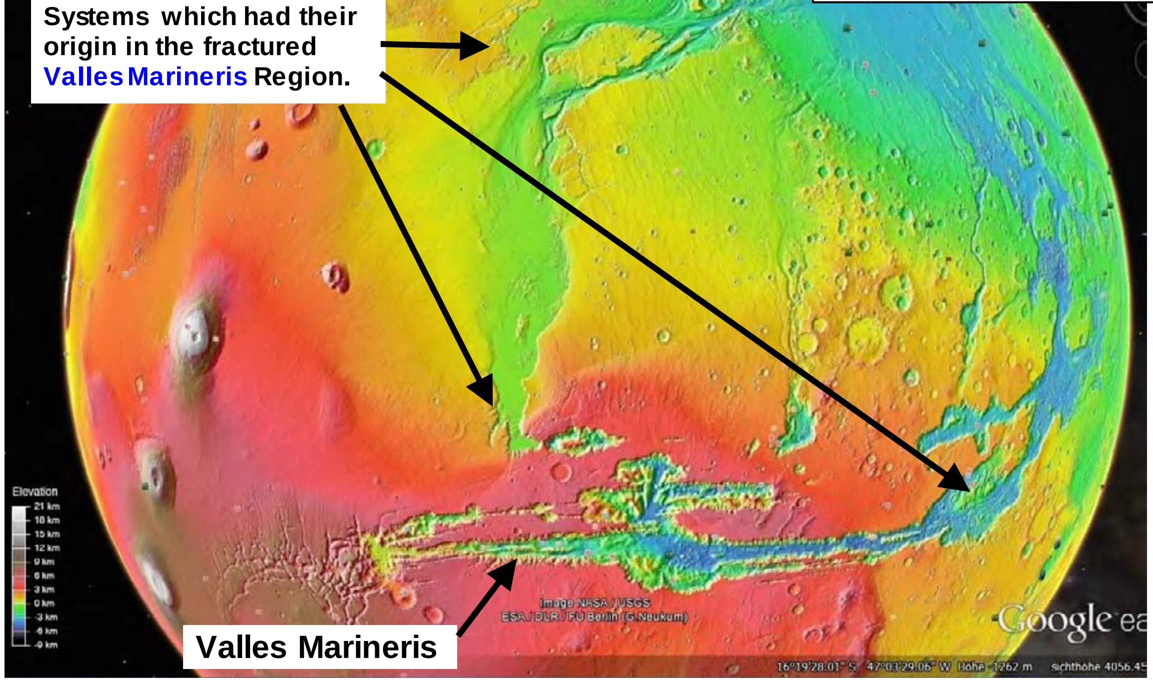
Part of the "forward ejecta" material (may contain dense metal-rich material from the three impactors)

That's where the edges of the left butterfly wing impacted on Mars' crust.. Note the linear edges !

Compare the biggest flood channels on Mars Kasei Valles & Ayres with the largest flood channels on Earth !!!



MARS GEOLOGY:
Rotating Globe Geology : see → weblink


Elevation
21 km
18 km
15 km
12 km
9 km
6 km
3 km
0 km
-3 km
-6 km
-9 km
Image NASA / USGS
ESA / DLR / FU Berlin (G.Neukum)
Google ea
16°19'28.01" S 47°03'29.06" W Höhe 1262 m sichthöhe 4056.45

Note the extensive River-Systems which had their origin in the fractured Valles Marineris Region.

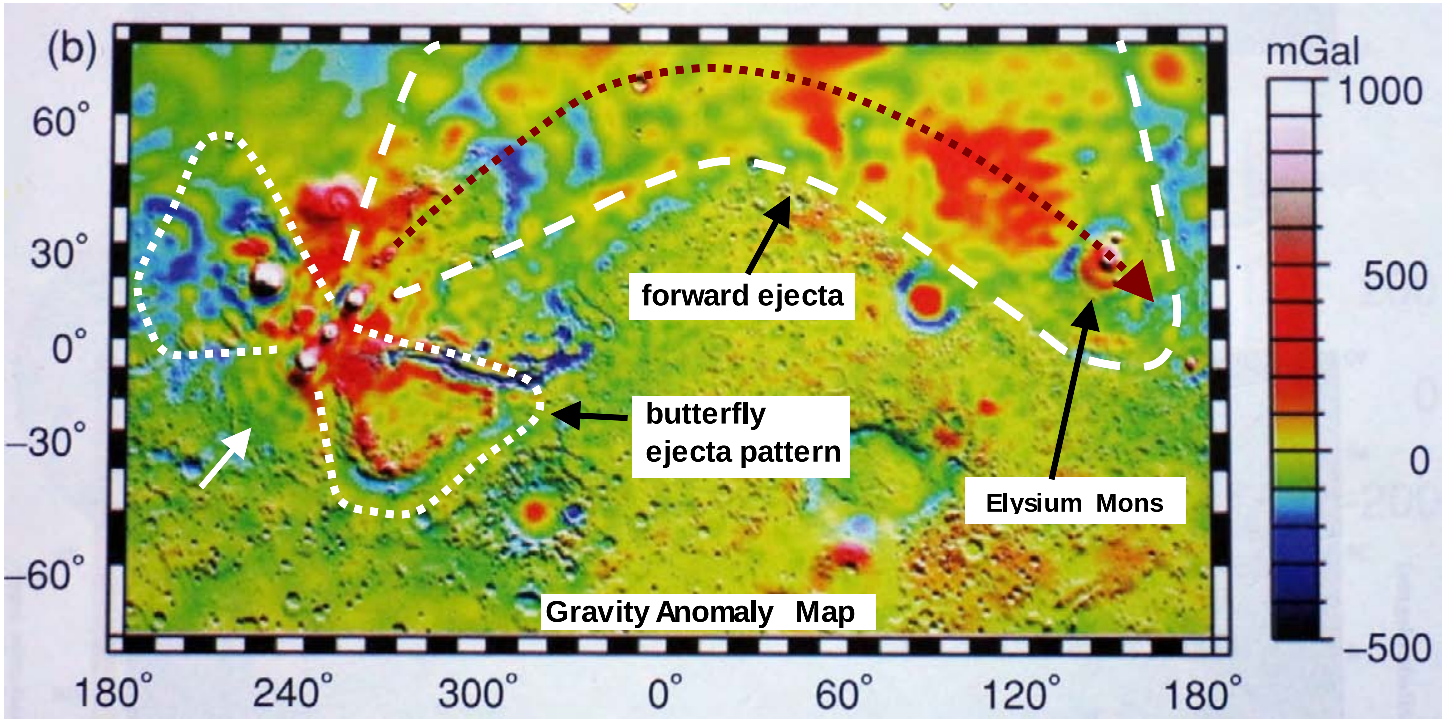
Valles Marineris

The strong concentration of the ejecta mass along the wing edges of the butterfly-ejecta pattern, as well as a powerfull forward ejecta blanket, cut open the complete crust of the northern hemisphere of Mars along the edges of the ejecta blanket and formed the ocean basins Utopia Planitia & Arcadia, which shortly after the impact began to fill with water.

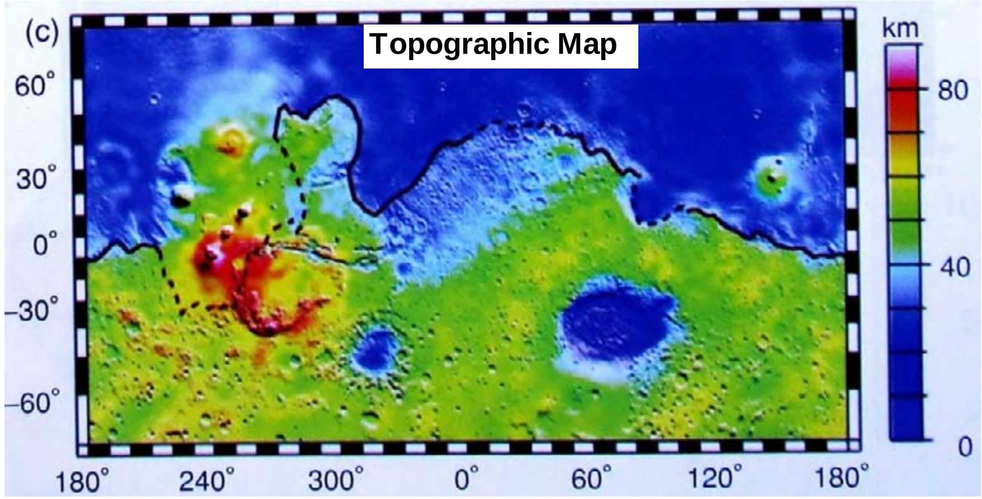
The maps on the righthand side show the full extension of the butterfly- & forward ejecta blankets. Because there was expansion tectonics going on in the last 100-200 Ma, the forward ejecta area was probably much smaller at the time of impact. Elysium Mons was caused by the impact of a fourth impactor from the same impactor group !

The topographic map on the bottom shows the dichotomy border-line on Mars' crust along which the crust was cracked & cut open by the ejecta

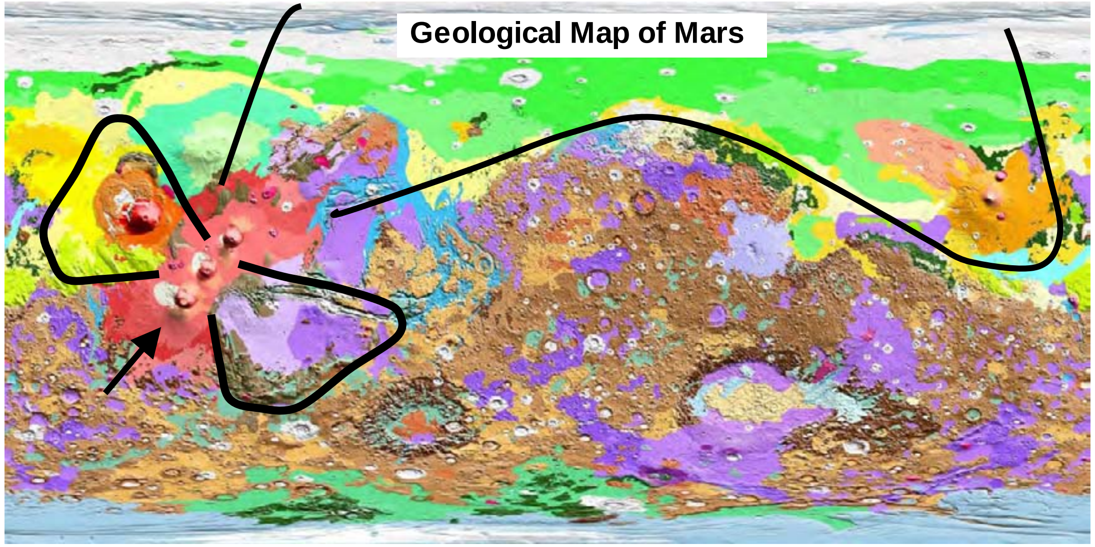
And the geological map nicely illustrates the massive geological change on Mars' surface caused by the impact event



Gravity Anomaly Map



Topographic Map

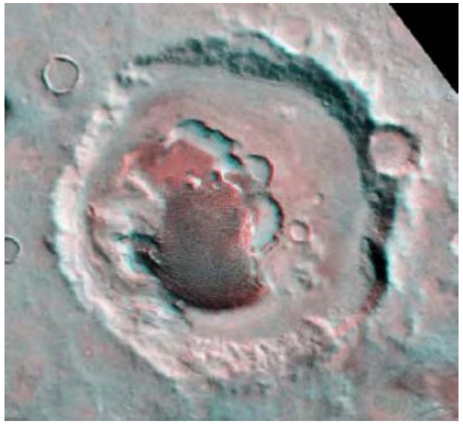


Geological Map of Mars

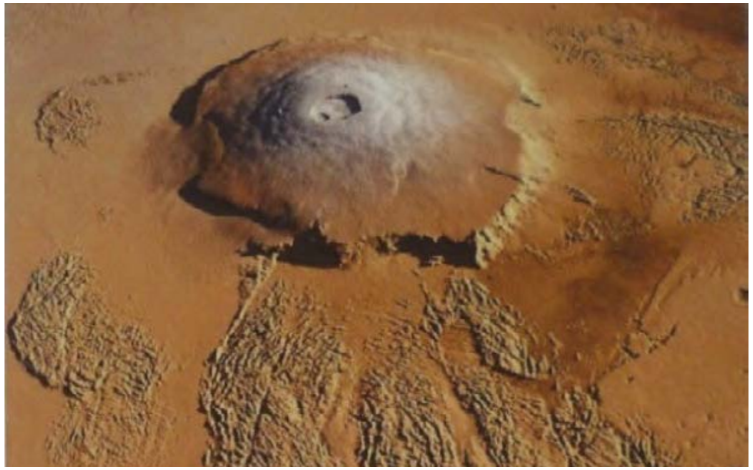
Mars’ large shield volcanos are not the result of hotspots, they are the result of large impacts !

The large shield volcanos of the Tharsis Montes region are the result of an impact event of global scale, caused by the nearly simultaneous impact of at least three large impactors ! They are not the product of so called hotspots. The three Tharsis Montes shield volcanos, and probably Elysium Mons as well, where caused by the fragments of a large asteroid or comet which probably broke apart just before impact !

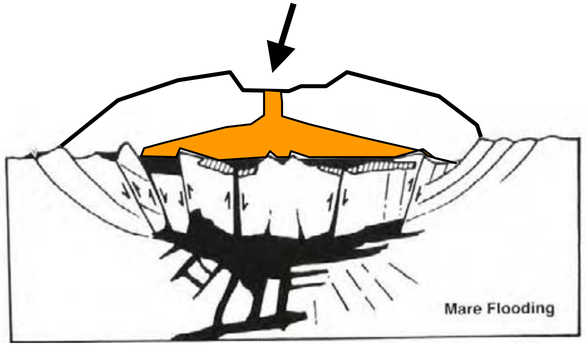
The two images below show how volcanic domes grow above large impact craters. This happens when the fractures under the crater, which result from the impact, are so extensive and deep that magma from the mantle can rise.
Then the conditions are given that shield volcanos like the large shield volcanos of the Tharsis Montes region on Mars, Ascraeus Mons, Pavonis Mons, Arsia Mons and Elysium Mons can form. Olympus Mons the largest shield volcano is probably also the direct result of an impactor or it is the result of impacting ejecta from the Tharsis Montes impacts.



The shield volcano Olympus Moons is 23 km high and 600 km in diameter, and is bordered by an escarpment up to 10 km high, at the foot of which a series of lobate deposits (ejecta lobes ?) extend for hundreds of kilometers.

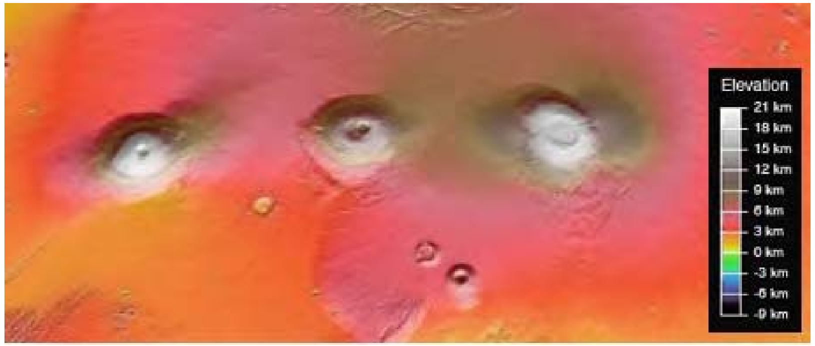


Shield Volcano grown above an impact crater

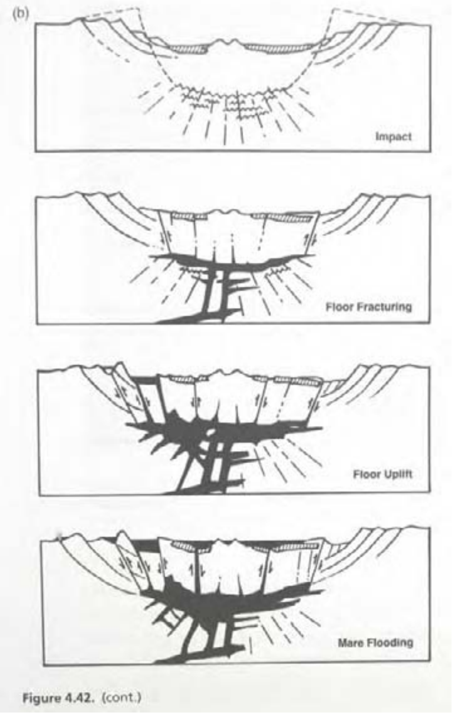


A crater with a fractured floor and massive outflow of magma can form a large volcano (a shield volcano) which rises high above the crater.
As the examples of craters with dome structures formed by magma clearly demonstrate. (see images on lefthand side)

Tharsis Montes region :



Fracturing of the crater floor of a large impact crater, and later flooding of the crater with magma flowing out of the cracks

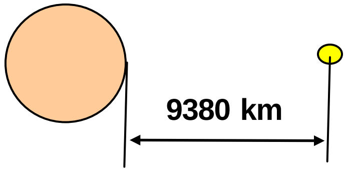


From : **Planetary Geomorphology**,
Ronald Greeley, ISBN : 978-0-521-86711-5

Mars moon Phobos provides further evidence for the described global impact event .

Mars moon Phobos is covered with parallel grooves which can only be created by a very large impact event on Mars. These grooves which were formed by parallel chains of secondary impactors are very dense on Phobos leading apex but completely missing on its trailing apex. This is strong evidence that a global impact event occured on Mars.

Note that the distance between Mars and Phobos is around 9400 km !



To give an impression of the distance which the ejecta from Mars travelled to produce the grooves : Phobos orbits Mars in an average distance of 9380 km !!

From „**Martian Geomorphology**“, M.R.Balme, A.S.Bargery, ISBN : 978-1-86239-330-1

from Page 27 :

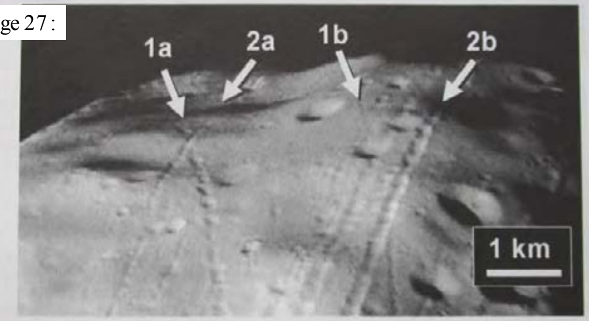


Fig. 6. The two parallel grooves 1a and 1b are cut by grooves 2a and 2b, respectively, indicating that the groove family represented by 2a and 2b is younger. From image h6906_0000.nd2. Image credit: ESA/DLR/FUB.

from Page 34 :

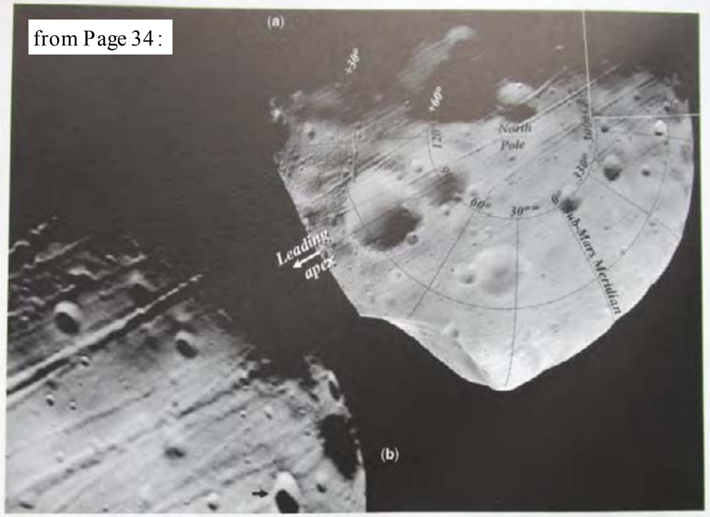


Fig. 14. (**a**) (Top right) Image h3310_0000.nd2 centred close to the north pole, dominated by the subparallel striations and crater chains of family A, the most complete groove family on Phobos that covers most of the northern hemisphere. Note that some individual grooves run unbroken for nearly 180° of latitude, and that the central groove of this family passes close to both the north pole and the leading apex. The tightly spaced grooves appear very straight and linear, but the super-resolution image (**b**, lower left) of the area in the box at top right shows that they comprise contiguous pits with raised rims (image h3310_sr2_0006). The top right-hand image is about 23 km left to right. Image credit: ESA/DLR/FUB.

Secondary impact chains from primary craters on Mars

The final hypothesis, that the grooves of Phobos are secondary impact crater chains from impacts on Mars, is explained in more detail in Figure 17. Unlike all of the other ideas, the pattern of grooves on Phobos almost exactly matches that predicted by theory (Fig. 12). On this hypothesis, each groove family originates from a large impact on Mars and is composed of radial (effectively parallel at the distance of Phobos) coalesced crater chains. These would, therefore, create the parallel plane intersections observed, each family having a different orientation, but the motion of Phobos would ensure that the plane passing through the leading apex of Mars would also pass through the centre of Phobos. This idea is also the only one that explains why each groove family covers only one hemisphere of Phobos, and also why the groove families are of different ages. The 'zone of avoidance' at the trailing apex of Phobos ties in exactly with what this hypothesis predicts: this is the only location that ejecta from Mars cannot reach because Phobos' forward motion in its orbit exceeds the ejecta velocity.

from Page 37 :

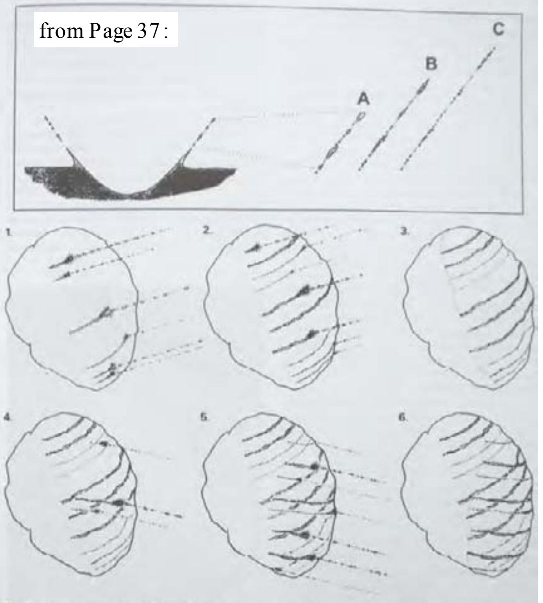


Fig. 17. Diagrams illustrating the formation of Phobos' grooves by the impact of ejecta from large impacts on Mars, from Murray *et al.* (1994). The top diagram shows a section through a large impact event on Mars, early in crater excavation. Highly shocked and melted material from both the impactor and the impacted surface is ejected at velocities of several km s^{-1} in a cone whose apex is the crater centre. The velocity of ejecta rapidly decays with time, so the leading part of each individual ejected jet of melt will steadily draw away from the following end and cause it to be stretched out into a progressively longer string of ejecta, as at A, B and C. The lower series of diagrams (1–6) shows the situation at Phobos. (1) and (2) Show radial (effectively parallel at the distance of Phobos) ejecta strings from the same impact on Mars arriving at Phobos, where Phobos' motion in its orbit (towards the lower right of the observer) causes long chains of secondary impact craters to form on its surface. (3) Shows the situation after the shower of debris has passed: nearly one half of Phobos is crossed with parallel grooves composed of contiguous secondary impact craters with raised rims. (4) and (5) Show the situation at a later time, when a different large impact on Mars results in the arrival of a second shower of ejecta, causing new parallel grooves to form at a different orientation from the earlier set. (6) Shows the final situation, with two families of parallel grooves crossing each other, each family covering only one half of Phobos.

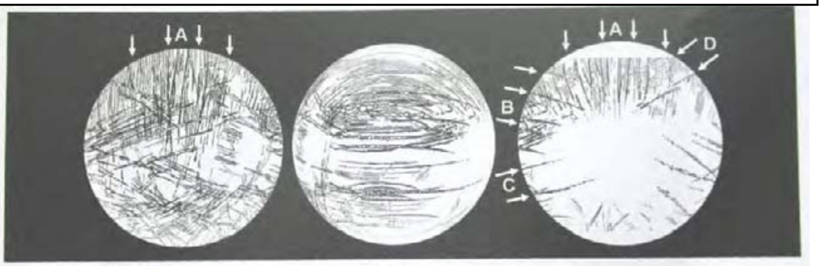


Fig. 7. (Top) Orthographic projections of groove positions on Phobos centred on (left) the leading apex (0° latitude, 90° longitude), (centre) the sub-Mars point and (right) the trailing apex. Note that grooves appear straight and in groups of parallel families when viewed from the leading and trailing apex (left and right). Four prominent families were named by Thomas *et al.* (1979); family A (the most prominent and numerous), B and D are marked. Also, note that all grooves become parallel along the sub-Mars meridian.

from Page 28 :

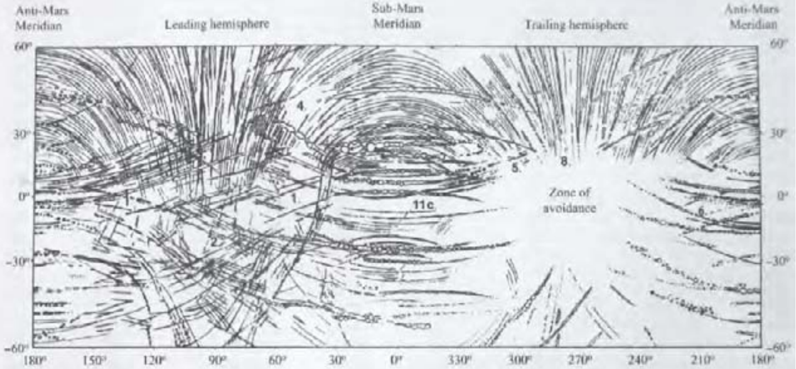
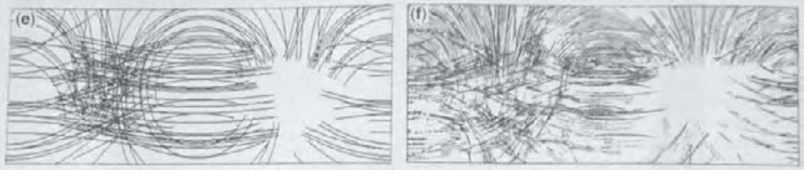


Fig. 1. Sketch map of grooves on the surface of Phobos derived from HRSC *Mars Express*, *Viking* and MGS (*Mars Global Surveyor*) images. A Mercator projection between −60° and +60° is used, and locations and orientations of features were assembled using crater positions from an existing control network (Duxbury & Callahan 1989). (1) Marks the centre of Stickney crater, the largest on Phobos; other numbers (2, 4, 5, 8 and 11c) refer to the approximate centres of figures in the text. Note that grooves become parallel along the sub-Mars and anti-Mars meridians (0° and 180°), and that there is a 'zone of avoidance' around which all grooves fade out and disappear surrounding the trailing apex (0° latitude, 270° longitude). The leading apex (0° latitude, 90° longitude) is characterized by groove families crossing each other at all orientations.

from Page 24



from Page 32

(**e**) (Lower left) Predicted secondary crater chain orientations from impacts at 12 different latitudes on Mars, chosen to match those seen on Phobos. Note the resemblance between this model and the map of grooves at the bottom. The model is simplified as a spherical Phobos, so does not fit the real situation as well as if it were modelled as a triaxial ellipsoid; nevertheless, the resemblance between theory and model illustrated in (e) is strong. (**f**) (Bottom right) Map of Phobos' grooves from HRSC images.

Remnant massifs of the highland-lowland (dichotomy) boundary are probably the result of a global Impact Event

The obtained absolut ages for the most recent resurfacing periods of these massifs (→ the covering of these massifs by large amounts of volcanic material) indicate that the global impact event may have happened in the range of **50 to 200 Ma** ago. It also seems that the volcanic material (the volcanic ash) which periodically covered these massifs contained large amounts of volatiles (probably mostly water), which evaporated within a certain time and caused big landslides etc., because of "volatile-activity"

The relatively smooth-appearance mantling deposit blankets most parts of the study area and overlies lowland plains and footslope aprons as well as the smoothly convex remnant massifs. It is prominent where landslide scars and small-scaled depressions, such as obliterated impact craters, form local catchment areas (Fig. 9d). At over-steepened

walls, mantling material accumulates at the footslope and reaches backwards uphill. Remnant crests marked by a central segmented ridge (Fig. 6a) often exhibit an overlying mantling material that terminates on both sides of the crest. This suggests the retreat of the covering material either by atmospheric loss of volatiles or by downwasting through slumping or creep at steep locations (Figs 6b, c & 7). Some of the displacement of a mantling layer occurs as glide flows, as indicated by polygonal sheets and circumferential ridges (Fig. 6b).

The mantling deposit is (a) superimposed on the remnant massif and (b) often detached from the

---

Remnant massifs of the highland–lowland boundary are either autochthonous, that is, they represent erosional remnants of highland material as suggested by geological mapping work (Scott & Tanaka 1986; Tanaka *et al.* 2005*a*) and earlier

discussions (Sharp 1973; Carr & Schaber 1977; Squyres 1979; Lucchitta 1984; Carr 2001), or they form uplifted crustal material as suggested for the southern hemispheric circum-Hellas and Argyre Planitiae remnants, as mapped by Greeley *et al.* (2006) (cf. question marks in Fig. 4). Alternatively, an allochthonous origin is conceivable although less likely, that is, emplacement by impact processes, similar to alternative explanations for the southern hemispheric remnant-apron features (e.g. Crown *et al.* 1992; Greeley *et al.* 2006).

Age constraints

For age determination, crater-size frequency distributions for nine lobate debris aprons were derived from undeformed impact craters. The obtained absolute ages provide proxies for the most recent resurfacing period and give some insight into the early past of apron formation or modification. Ages are in the range of 10–50 Ma, with early traces dating back to 100 Ma and up to 200 Ma ago (Table 4 & Fig. 12). Old ages for #9 are old signatures in the terrain covered by debris aprons; such older impact craters are partially filled by debris-apron material. Segmentation and stair-stepped frequency curves indicate multiple resurfacing events. Shallow branches of frequency curves strongly suggest the continuation of denudation and/or resurfacing and obliteration of older

impact craters. Individual branches indicate a clear phase at 50 Ma ago and some modification process dating back to 10–20 Ma ago. It cannot completely

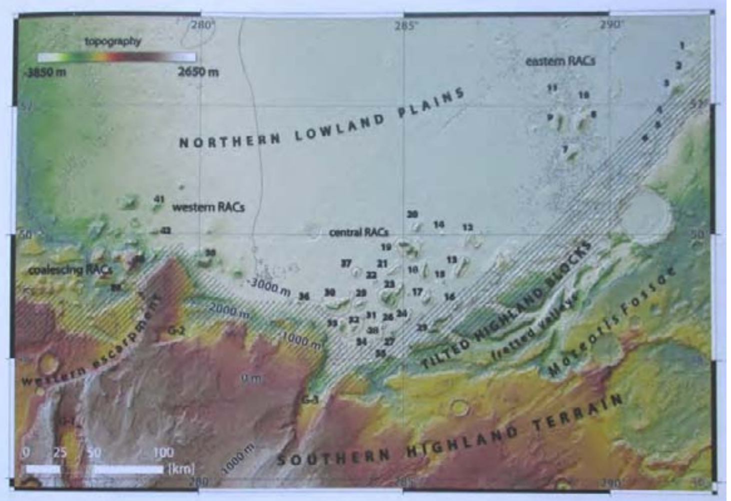


Fig. 2. Topography and general settings of the Mareotis Fossae–Tempe Terra study area; hillshade representation on colour-coded digital terrain model data as represented by a terrain model mosaic derived from bundle-block adjusted HRSC image scenes (Table 1). Labelled remnants/aprons are featured landforms referred to in the main text and used for morphometric studies. Elevations are based on the Mars areoid; the hatched area marks the escarpment transition between the southern highlands and northern lowlands. Isolines have a 500 m spacing (1 km lines are drawn solid), illumination is from upper left, map projection is Mercator. North is up. Image credit: ESA/DLR/FUB; see prelim viii for acronym definitions.

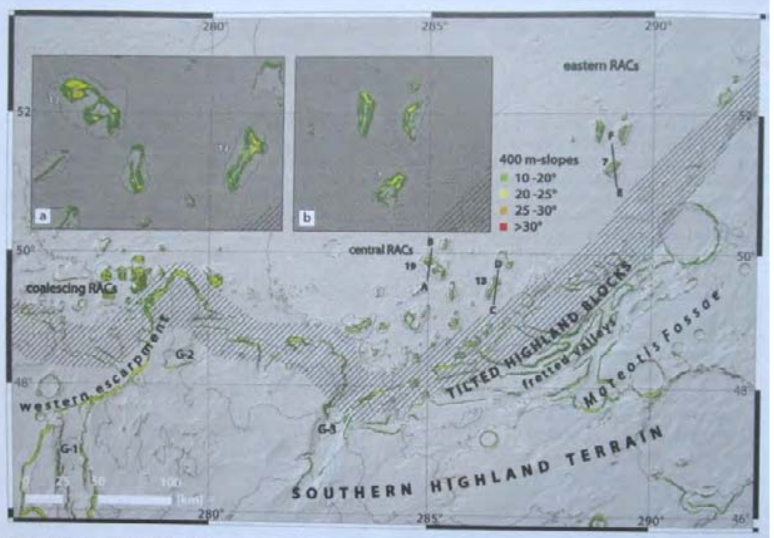


Fig. 5. Map in a hillshade-relief representation with superimposed slope data of remnant massifs and debris aprons. Slope data have been derived from 400 × 400 m digital terrain model data to avoid low-frequency noise. Locations of profiles are marked in the overview map, insets (**a**) and (**b**) show details of RAC features 7, 13 and 19 where topographical profiles are located. North is up in all images.

From **„Martian Geomorphology"**, M.R.Balme, A.S.Bargery, ISBN : 978-1-86239-330-1

from Page 49 to 60

Note the fluid-like appearance of the cover material of the massif !

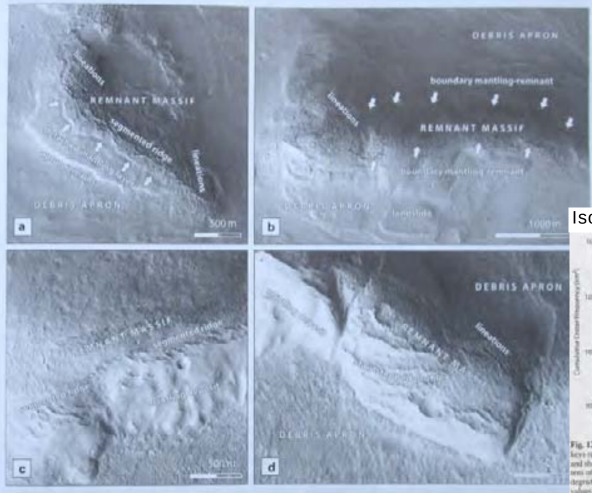


Fig. 6. Remnant massif constructs located in the western study area (278.5°E/49.5°N). (**a**) Remnant massif showing a dissected remnant surface in the detached mantling layer. The relict ridge at the crest indicates the former extent of the mantling material (CTX P19_008537_2285_XI_48N080W, complex feature #41, Fig. 2). (**b**) Remnant massif with a detached mantling layer, which is partly draped over the remnant wall rock (CTX P19_008537_2285_XI_48N080W, complex feature #41, Fig. 2). (**c**) and (**d**) remnant wall rock dissected by deeply incised gully features and stair-stepped profiles indicative of differential downslope mass movement and heavy degradation as suggested by impact-crater obliteration. Traces of remnant mantling layers are indicated at the footslope and remnant ridges on the wall rock (CTX P18_008102_2285_XI_48N081W, feature #39, Fig. 2). North is up in all images. Image credit: NASA/JPL/MSSS.

Isochrones & crater-size frequency measurements

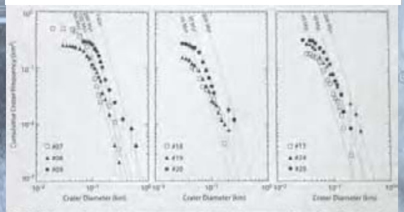


Fig. 12. Isochrones and crater-size frequency measurements for nine debris aprons in Tempe Terra. Numbers in the keys refer to the aprons labelled in Figure 2. Segmented and stair-stepped curves indicate multiple resurfacing events and shallow segments suggest the continuation of denudation and/or resurfacing. Absolute ages are in the range of few tens of Ma, with early traces dating back to 100 Ma and up to 200 Ma ago. For all aprons, intensive [illegible] and degradation with numerous subconcentric pits on the debris apron complicates the derivation of proper ages so that these values are considered as absolute minimums. For the statistics see Table 4.

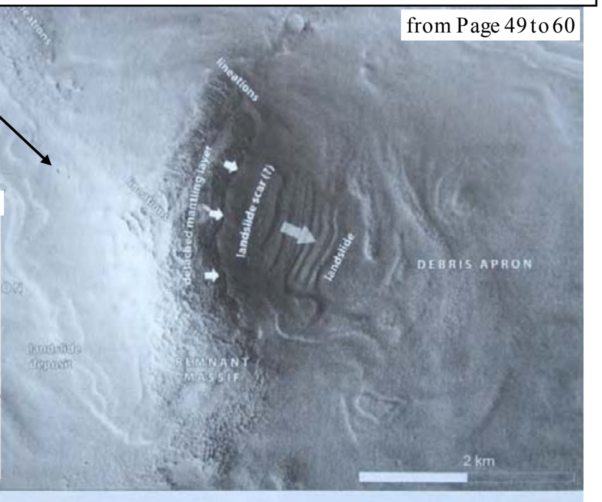


Fig. 7. Complex remnant-apron construct showing several episodes of resurfacing, as indicated by an old landslide scar, obliterated impact craters, parallel surface lineations and several younger phases of deformation of mantling deposits leading to landslides and accumulation on, as well as reworking in, lobate aprons. The mantling deposit is detached from the remnant massif (P19_008537_2285_XI 48N080W, feature #41, Fig. 2). North is up. Image credit: NASA/JPL/MSSS.

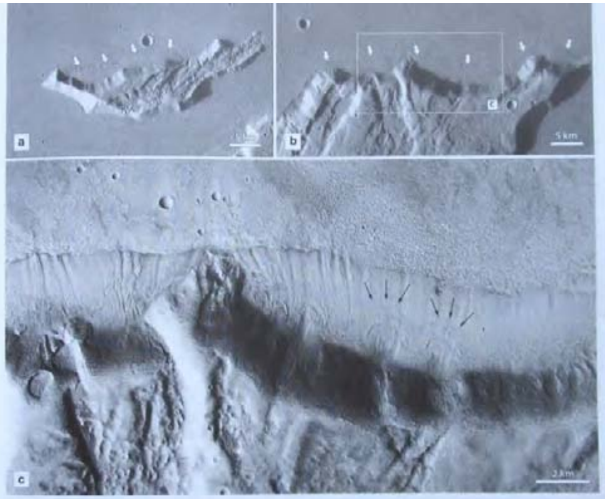


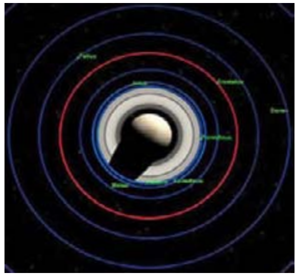
Fig. 10. Lobate debris aprons at isolated remnants in western Tempe Terra. The distribution and dimensions of lobate debris aprons in this more southern part are different from features located in more northern locations of Tempe Terra (Fig. 11). (**a**) Massif at 35.36°N with lobate debris aprons (white arrows) on the northern side, but not on the southern side (detail of HRSC image h5081 0000; centre at 35.36°N and 268.65°E; north is up, illumination is from the west/left). (**b**) Remnant highland massif with marginal lobate debris apron (white arrows). Lineations on lobate debris apron are parallel to the inferred flow direction (detail of HRSC image h5081_0000; centre at 35.0°N and 267.9°E; north is up, illumination is from the west/left). (**c**) Detailed view of lobate debris apron shown in (b); a convoluted or undulating pattern in plan view characterizes the texture of the upper (southern) parts of the apron. The position of lobes (e.g. black arrows) are controlled by indentations of the southern scarp (detail of CTX image P17_007852_2154; north is up, illumination from the SW/lower left). Image credit: ESA/DLR/FUB and NASA/JPL/MSSS.

8a Enceladus, a moon of Saturn, shows evidence of a global impact event, which probably happened < 200 Ma ago

Enceladus was hit by a large impactor, with a diameter in the range of 10 to 40 km on it’s leading hemisphere. This caused an impact crater (a circular impact structure) with an outer diameter of approx. 350 km and an inner diameter of approx. 200 km. This happend in the geological recent past, probably less than 200 Ma ago.

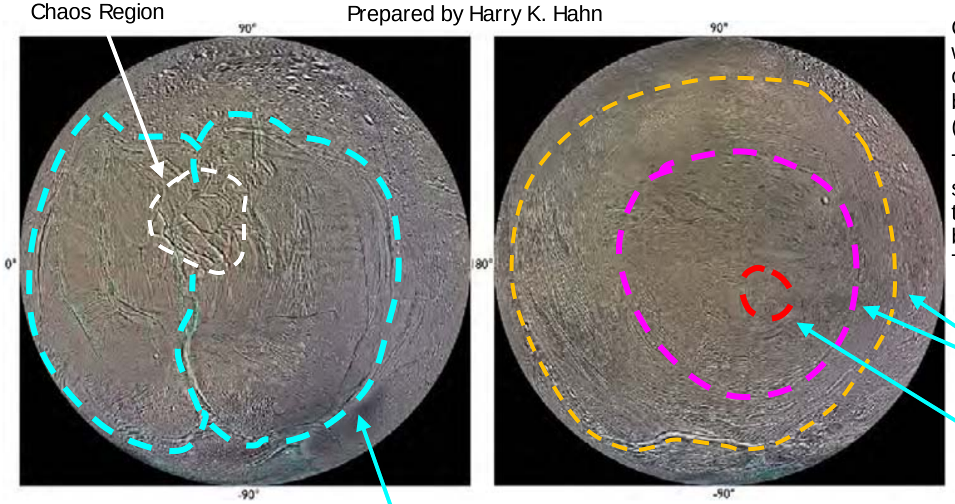
The current believe is that the so called Tiger Stripes in the southern pole area are caused by tidal pull from Saturn’s gravity. But this is incorrect ! The tiger strips are the result of largescale global deformation on the small Saturn Moon Enceladus caused by the yet unknown global impact event. This impact event not only caused a global fracture pattern. It also caused expansion tectonics on the moon and largescale cryovolcanism in the southern hemisphere, which is still going on today. The jets coming out of the cryovolcanos mainly contain water out of the upper mantle of the moon

Diameter : 503 to 513 km
Orbital Period : 1.37 days
Semi-major axis : 237948 km
(orbit around Saturn)
Inclination : 0.019°
(to Saturn’s equator)
Orbital velocity : around 12 km/s
Rotation Period : synchronous
(always faces same side to Saturn)



Enceladus's orbit (marked in red) from above Saturn's north pole

Prepared by Harry K. Hahn



Trailing Hemisphere

Leading Hemisphere

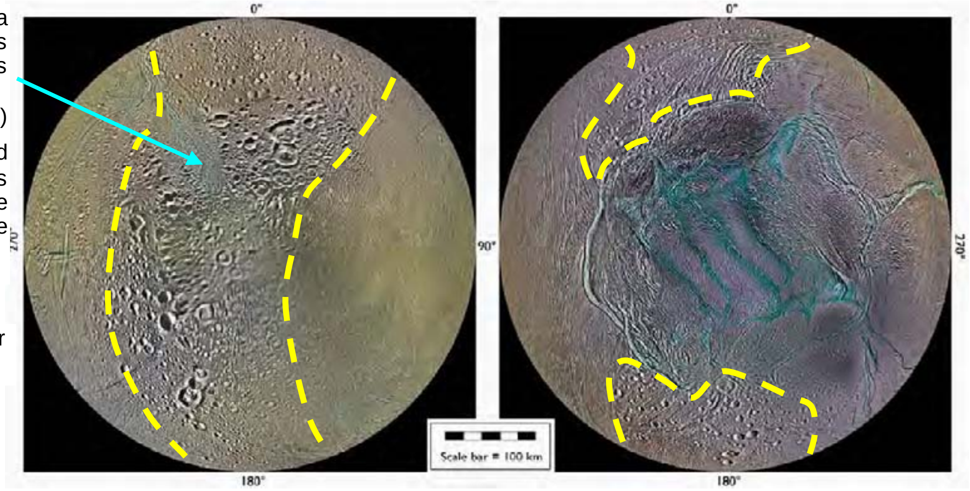
Outer & inner impact area

Center of Impact

two kidney-shaped “tectonic-plates” caused by the impact shockwave

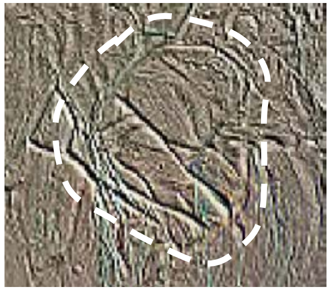
Old surface area with many craters only within this belt-shaped area (see yellow lines)

The belt with old surface area is terminating on the borders of the Tiger Strips Area



Northern Hemisphere

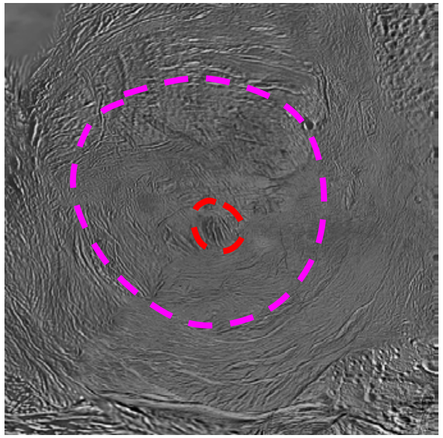
Southern Hemisphere

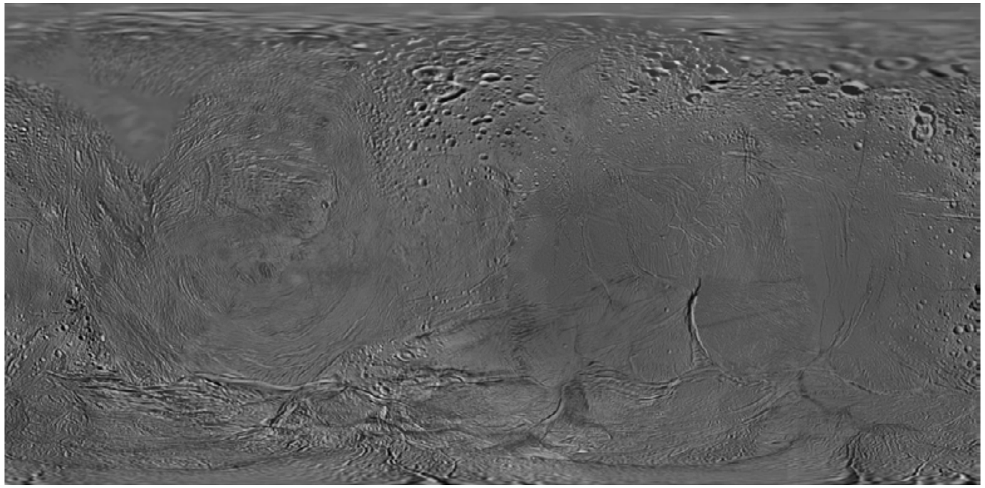


Detail view of the chaos region near the center of the Trailing Hemisphere.

This is where the peak of the shockwave, which travelled through the deep mantle, hit the trailing hemisphere from the inside. The two kidney-shaped “tectonic-plates” on the trailing hemisphere indicate that the shockwave travelled around a solid core before focusing in a peak area on the trailing side

Detail view of the inner impact area



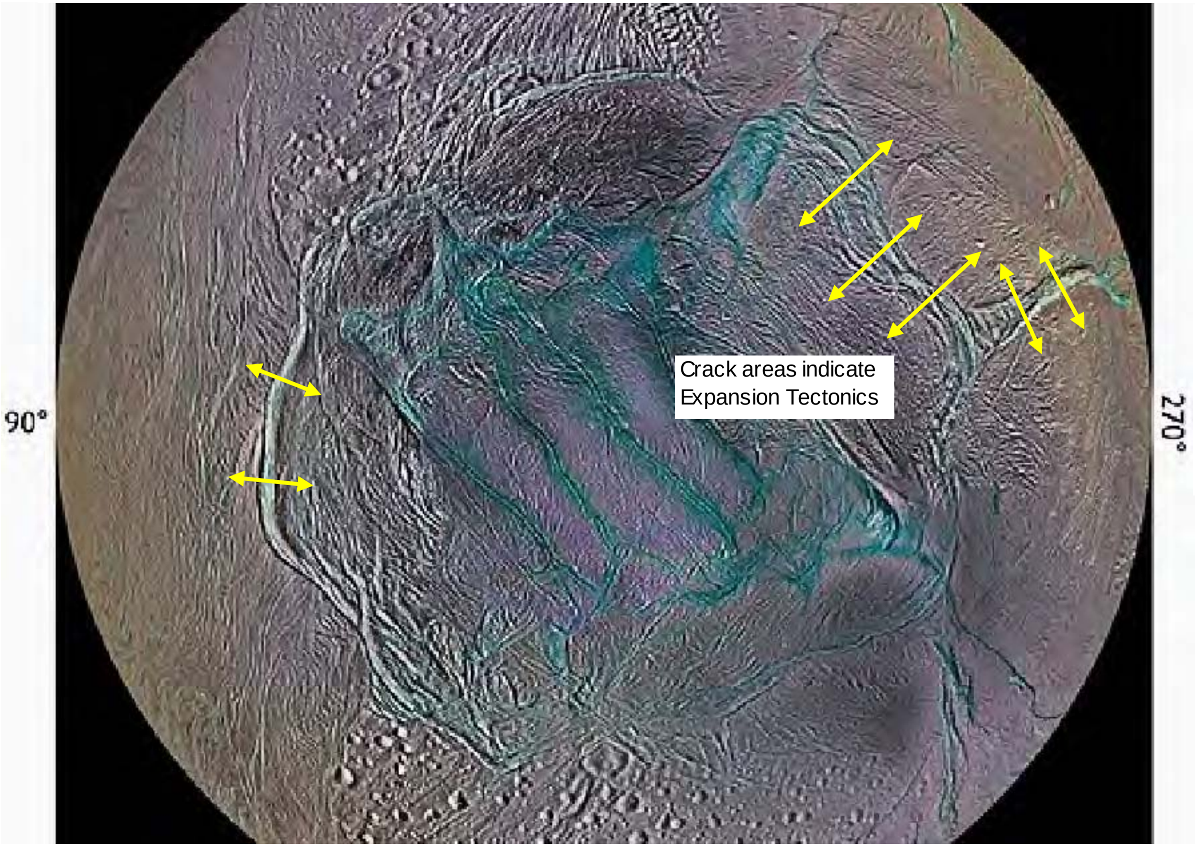


Enceladus Complete Surface Map

The “Tiger Strips” on Enceladus are the result of the described global impact event

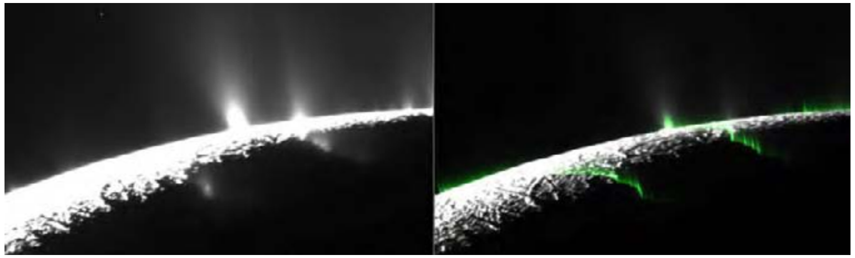
Prepared by Harry K. Hahn , 24.09,2015

The Tiger Stripes on Enceladus southpole-area are the result of the largescale impact event and the following global deformation of the moon. The global deformation of Enceladus was caused by the shockwave which was triggered by the impact. This shockwave travelled through the interior of the moon and caused large scale fracture patterns on the leading- and trailing hemisphere. However a belt between the leading- and trailing hemisphere survived mostly without damage, with exception of the Tiger Stripes area. But because there is strong indication of Expansion Tectonics in this Tiger Strips area, it can be concluded that the whole moon expanded considerably after the impact ! And it seems that the expansion of the moon is still going on. The wide crack areas and the ongoing cryovolcanism are indicators for this ! The expansion of the moon must be driven by the mantle-volatiles ejected by the jets.

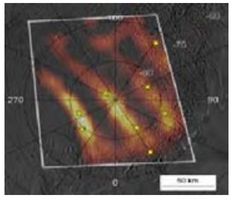


Crack areas indicate
Expansion Tectonics

Detail view of the Tiger Strips area on Enceladus Southern Hemisphere

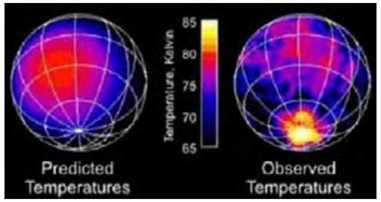


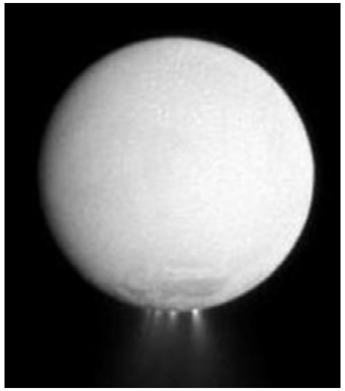
Researchers modeled eruptions on Saturn's moon Enceladus as **uniform curtains** along prominent fractures that stretch across the icy moon's south pole. **(→ Compare this to the Mid-Ocean-Ridges on Earth ! → comment by Harry K. Hahn)**
The scientists found that brightness enhancements appear as optical illusions in places where the viewer is looking through a "fold" in the curtain. The folds exist because the fractures in Enceladus' surface are more wavy than perfectly straight. The researchers think this optical illusion is responsible for most -- but not all -- of what appear to be individual jets. Some discrete jets are still required to explain Cassini's observations.



The fractures
are much
warmer than
surrounding
area

Enceladus heat color map





Jets of water and ice shooting up from “the Tiger Stripes” on Enceladus. The volcanoes along the fractures are known as cryovolcanos, meaning "volcanoes of ice". The jets are mostly water, they also contain ammonia, methane, carbon dioxide, nitrogen, and trace amounts of hydrocarbons as well as solid material including sodium chloride crystals and ice particles.
The jets (or plumes) at Enceladus seem similar in chemical makeup to comets (according to NASA scientists).
There is evidence for a large south polar subsurface ocean of liquid water within Enceladus with a thickness of around 10 km.

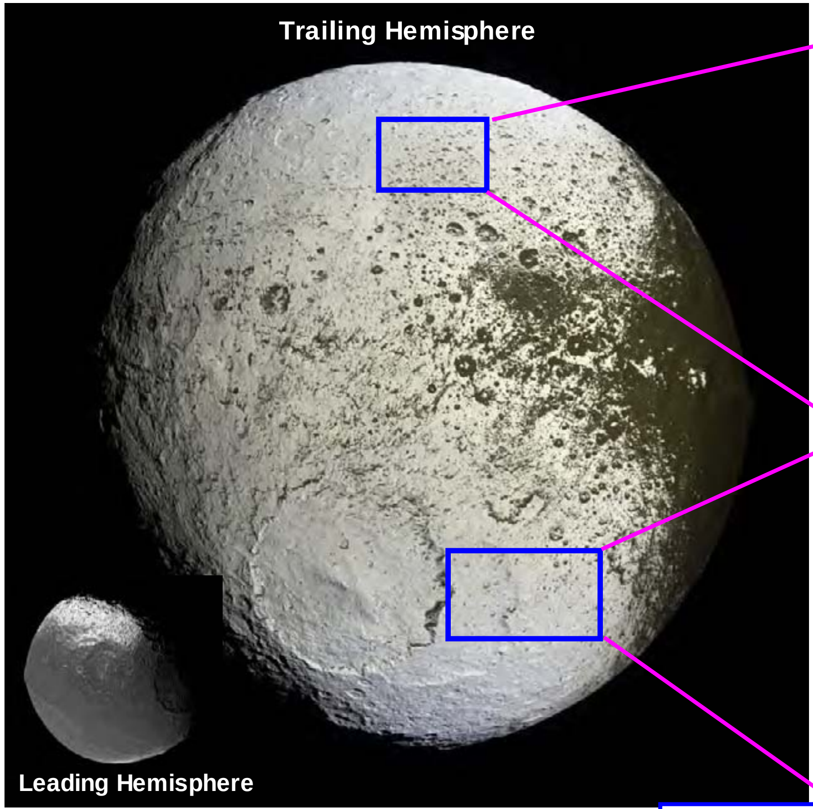
The Tiger Stripes (Enceladus) → From Wikipedia

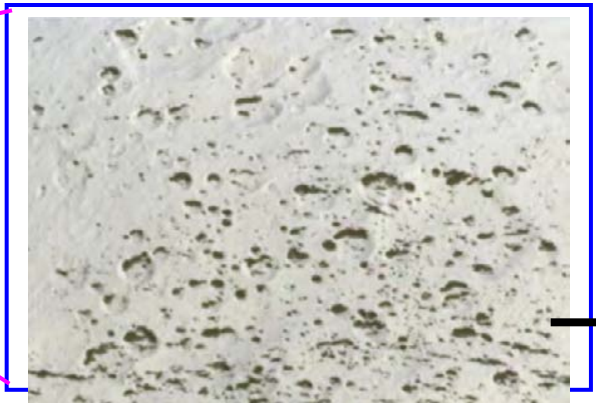
The stripes are spaced approximately 35 kilometers apart. The ends of each tiger stripe differ in appearance between the anti-Saturnian and sub-Saturnian hemisphere. On the anti-Saturnian hemisphere, the stripes terminate in hook-shaped bends, while the sub-Saturnian tips bifurcate dendritically.
Virtually no impact craters have been found on or near the tiger stripes, suggesting a very young surface age. Surface age estimates based on crater counting yielded an **age of 4–100 million** years assuming a lunar-like cratering flux and 0.5-1 million years assuming a constant cratering flux

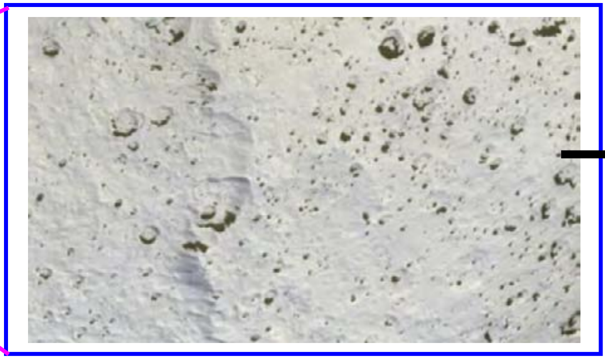
IImages from the ISS camera onboard *Cassini* revealed the 4 tiger stripes to be a series of sub-parallel, linear depressions flanked on each side by low ridges. On average, each tiger stripe depression is 130 kilometers long, 2 kilometers wide, and 500 m deep. The flanking ridges are, on average, 100 meters tall and 2–4 kilometers wide. Given their appearance and their geologic setting within a heavily tectonically deformed region, the tiger stripes are likely to be tectonic fractures. However, their correlation with internal heat and a large, water vapor plume suggests that tiger stripes might be the result of fissures in Enceladus' lithosphere.

8b The icy surface on Saturn Moon Iapetus originates from a large cryovolcano which is the result of a global impact

The analysis of NASA, that Iapetus had originally a complete icy surface which was covered with dark material, is incorrect ! It is the opposite way ! Iapetus had originally a rocky surface which was covered by ice from a very large cryovolcano, resulting from a global impact. This impact formed the ∅ 580 km Turgis Impact Basin. And the equatorial ridge may be the result of the water-loss of the mantle region of Iapetus caused by the cryvolcanism.

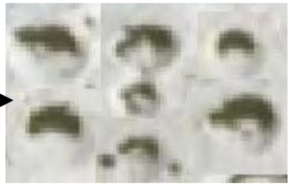




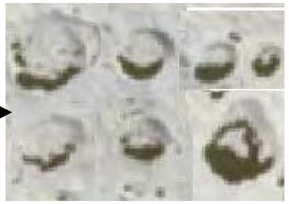


The following explanation will provide the hard evidences for this statement !!

Diameter:	**1470** km
Orbital Period:	79,32 days
Semi-major axis:	3 560 820 km
(orbit around Saturn)	
Inclination:	15,47°
(to Saturn's equator)	
Orbital velocity:	around 3,26 km/s
Rotation Period:	79,3 d synchronous
(always faces same side to Saturn)	

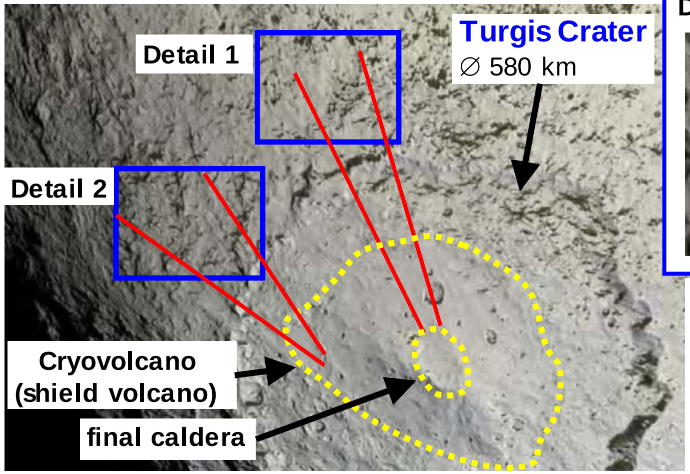


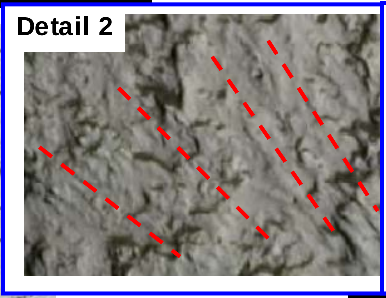
Note the appearance of the craters from the selected areas in the northern- and in the southern hemisphere !!

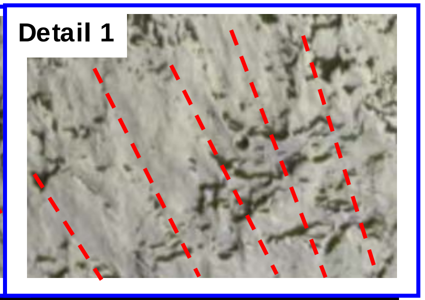


It is easy noticable that the dark areas in the craters must be caused by melting (sublimation) of the ice which covers a dark rocky surface !!

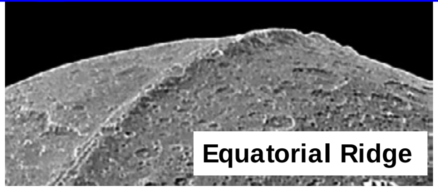
It is always the area of the craters which faces towards the sun, where there is no ice-cover ! This can only mean, we are talking about a thin ice cover on a rocky surface !! And this thin ice cover (< 100 m ?) has sublimated away from the sun-facing rocky surface areas of Iapetus !!







The low coefficient of friction (0.1-0.3) of the Iapetus ice avalanches is probably caused by heat coming from the impact area (warm ice)



The ice-cover on Iapetus with high probability came from a large cryo-volcano in the Center of the Turgis Crater, which means that the Turgis Crater is responsible for the ice cover on Iapetus Trend-lines in the ice formations around the crater clearly indicate that the ice came from the marked cryo-volcano area. And the equatorial ridge therefore must be the result, of either the impact shockwave, the water-loss in the mantle & tidal forces, or the combination of them.

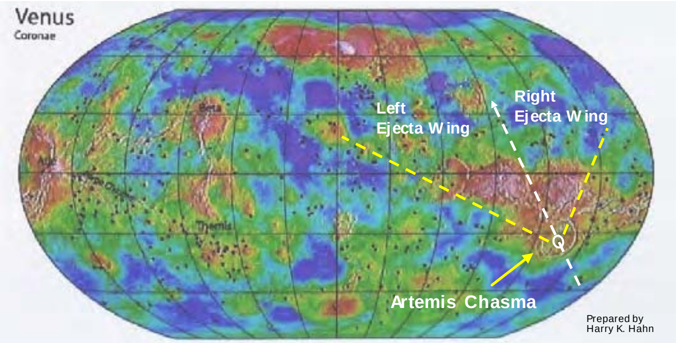
9

Planet Venus and Earth’s Moon also show traces of global impact events and Expansion Tectonics

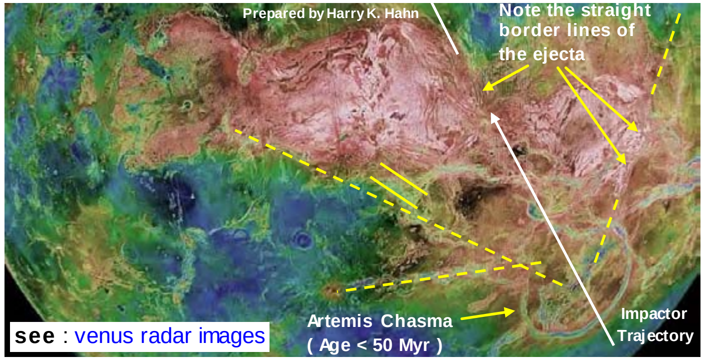
Venus

Prepared by Harry K. Hahn

Conventional interpretations assign Venus a volcanotectonic surface pocked only by ~1000 small impact craters. But this is incorrect ! Much of venusian plains are full of 100-600 km circular structures. And there are dozens of circular basins reaching up to 2500 km in diameter. All these circular structures are impact structures ! And the larger ones with > 1000 km diameter are responsible for triggering extensive expansion tectonics on Venus. The hard evidence for this statement will be Artemis Chasma, which was caused by the oblique impact of a large impactor > Ø 20 km with an orbit inclination > 45° (→ probably an Oort Cloud- or Sgr-DG- Comet or -Asteroid) !!



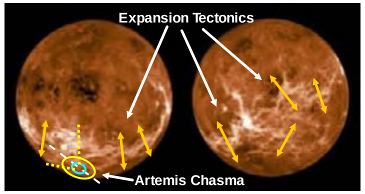
Topographic Map of Venus with coronae marked (→ black dots)

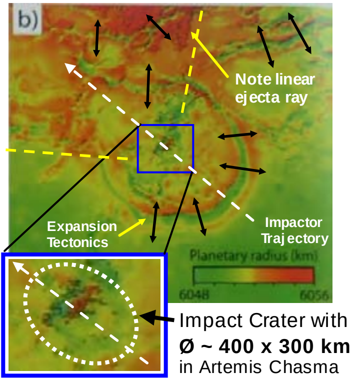

Prepared by Harry K. Hahn
Note the straight border lines of the ejecta
Artemis Chasma
(Age < 50 Myr)
Impactor Trajectory

see : venus radar images

Topographic Map centered at 90° longitude (Magellan datas)

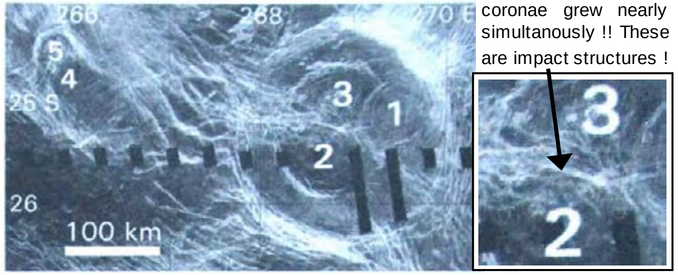
Artemis Chasma is not a structure (coronae) which was caused by a mantle plume (current theory) ! Artemis Chasma definitely was caused by an impact !! There are a number of clear visible trendlines which mark the outline of the buttlerfly ejecta-blanket of this olique impact !! And it is clear that the impact- and the ejecta-impulses triggered global Expansion Tectonics on Venus, which is noticeable as a belt-like global fracture pattern (white) on the radar image below





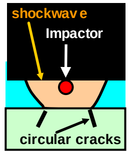
Impact Crater with **Ø ~ 400 x 300 km** in Artemis Chasma

I recommend to read the article : **“An alternative Venus”** from Warren B. Hamilton in the book : **“Plates, Plumes and Planetary Processes”** : ISBN 978-0-8137-2430-0



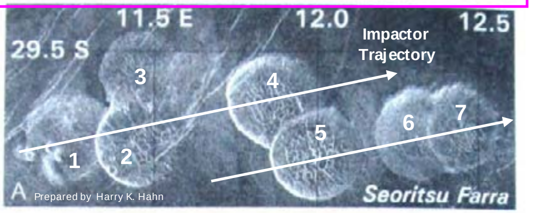
Note the nearly linear border line between coronae 2 & 3 !! Both coronae grew nearly simultanously !! These are impact structures !

From all the **Coronae** structures shown on the image only a smaller structure (Elza Crater) is conventionally assigned an impact origin. However all these coronae structures are impact structures !! The large 200 km coronae (Hervor Coronae) is actually cut by 3 nested craters from almost simultaneous impacts (by fragments of a comet or asteroid), of which 1 cuts 2, which cuts 3 !

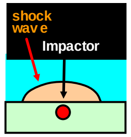


The image above describes how a Coronae is caused by the spherical shockwave caused in the very dense Venus Atmosphere The crust is dented and a circular crack pattern is the result

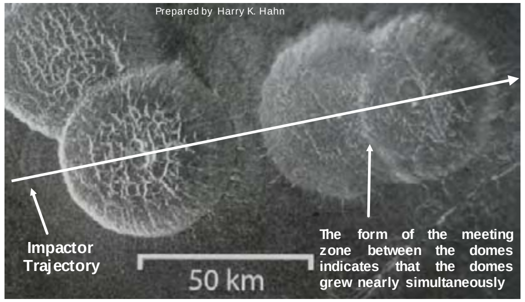
Coronae and **Pancake Domes** are definitely all impact structures ! Here coronae are probably the result of a powerfull atmospheric shockwave which causes a dent in the crust which then leads to the circular fracture pattern. And Pancake domes result from spherical shockwaves raising from under the ground



These plain features commonly regarded as volcanoes that appear instead to be of impact origins. (A) Chain of low **Pancake Domes** which show eastward-younging cookie-cutter superpositions, not magmatic-interference patterns !, and that are probably constructs of impacts in soft sediments by fragments of a comet or asteroid which was disrupted by Venus’ gravity .



This image above shows how the shockwave of an impactor which hit the ground causes a Pancake Dome The very dense Venus Atmosphere prevents the ejecta from flying away.

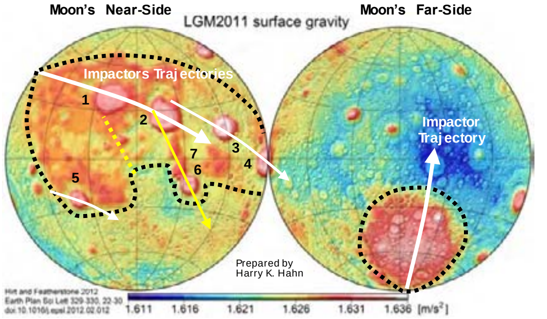


The form of the meeting zone between the domes indicates that the domes grew nearly simultaneously

Earth’s Moon

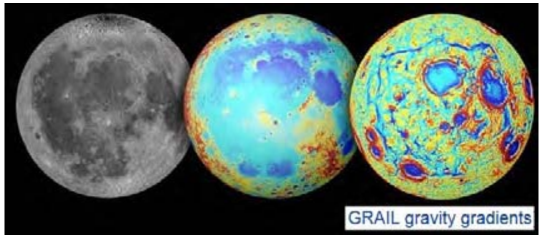
Prepared by Harry K. Hahn

The gravity anomaly maps of Earth’s Moon indicates at least one global impact event which triggered Expansion Tectonics on the Moon. This impact event caused the Mare areas on the near-side of the Moon. Another big impact event caused a circular area of Ø1500 km on Moon’s far-side which comprises a handfull 200 km craters (Leibnitz- & Apollo-crater etc)



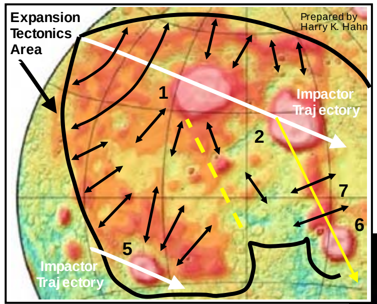
The global impact event

The global impact event on Moon’s near-side was caused by at least 5 large impactors, probably fragments of an asteroid, with Ø 10 - 60 km each ! These impactors caused the base craters **No.1 - 7** with the diameters : 600, 550, 420, 530, 320, 330 and 220 km, which then produced most of Moons flood-lava filled Mare. →



The Mare formed by the impact craters No. 1 - 7 :

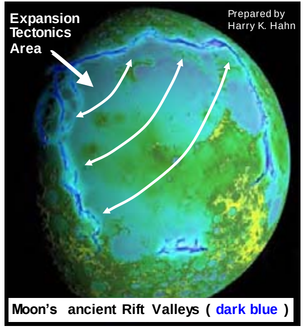
Mare 1 – 7 : Imbrium , Serenitatis , Crisium , Smythii , Humorum Nectaris , Asperitatis → the last two Mare are secondary craters !



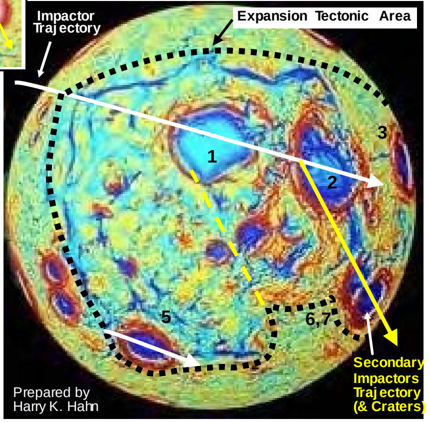
Expansion Tectonics on the Moon :

The nearly simultanous impact of the mentioned ≥5 impactors caused an extensive fracture pattern on Moon’s near-side. Similar as on Earth, volatiles in the mantle must then have been the driving force for the following expansion of Moon’s mantle. These volatiles must have been in a super-saturated state at the time after the impact when Expansion Tectonics began. Because of their size the impactors may have been a result of the P-T Impact or of the 1. or 2. Sgr-DG pericenter event

Note the similarity to Earth’s North-Pacific-Area !

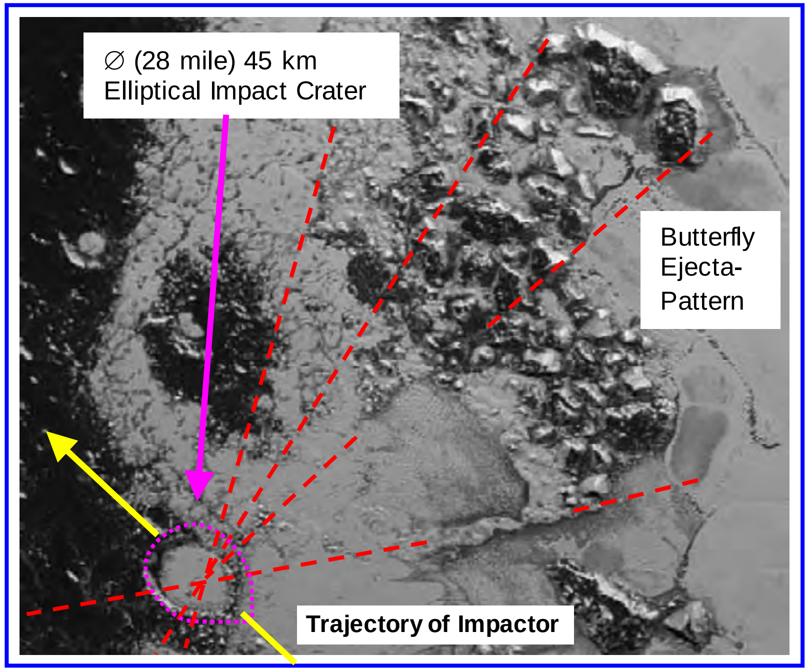


Moon’s ancient Rift Valleys (dark blue)


Impactor Trajectory
Expansion Tectonic Area
1
2
3
5
6,7
Prepared by Harry K. Hahn
Secondary Impactors Trajectory (& Craters)

9a On Pluto the “heart-shaped” region & Sputnik Planum were formed by a complex global impact event

There are different geological formations around Sputnik Planum, which indicate an impact origin. Sputnik Planum itself seems to be the result of several big impacts which caused a large fracture and led to expansion tectonics and volatiles rising from the mantle to Pluto’s surface in this area



The mountain areas around Sputnik Planum, e.g. Hillary Montes and Norgay Montes, are the result of a multiple Impact event. With high probability the fragments of a burst comet or asteroid formed these mountains, when they impacted on Pluto.

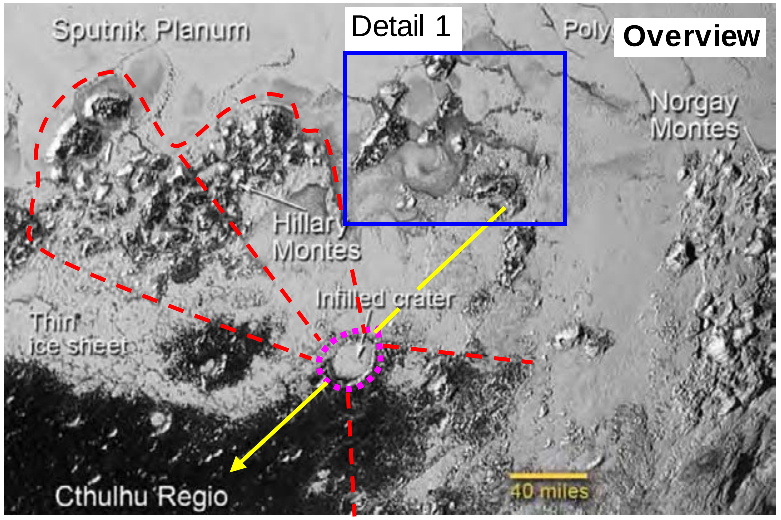
The image on the lefthand side shows clear trend-lines in the Hillary Montes region which all originate in an approx. 28mile (45km) wide crater, which is infilled with ice now Hillary Montes at the border line of Sputnik Planum probably formed less than 100 million years ago as a result of this impact event. (see also : Pluto images from NASA) “This is one of the youngest surfaces we’ve ever seen in the solar system,” said Jeff Moore (from the Geology, Geophysics and Imaging Team (GGI) / NASA)

“Because Pluto cannot be heated by gravitational interactions with a larger planetary body, some other process must be generating the mountainous landscape” said GGI deputy team leader John Spencer.

And he is right ! The mountains were formed by a complex multiple impact event !
The small 28 mile wide crater is only part of a much larger impact event !

From the slightly elliptical shape of this crater the trajectory of the impactor can be determined. The trajectory of the impactor and the arrangement and position of the butterfly-ejecta of this oblique impact crater give indication about the possible position of further impact craters and ejecta areas which all belong to this complex impact event.

The image below shows an overview of the surface features around the Hillary Montes where the small elliptical crater with butterfly-ejecta pattern is visible

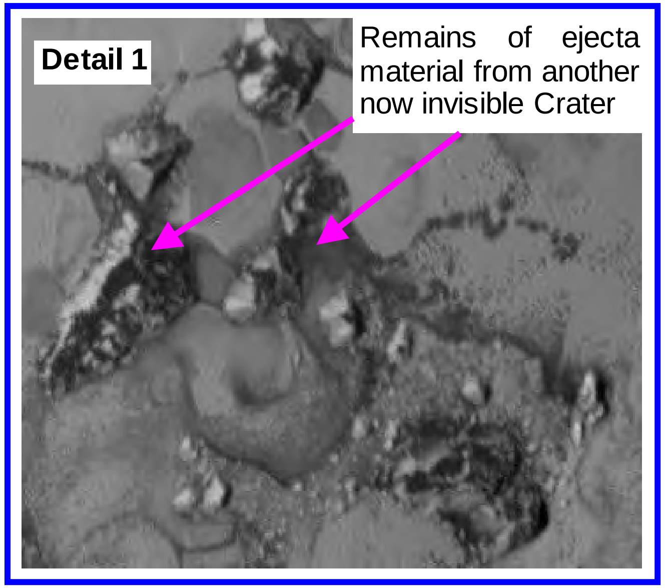


The area “Detail 1” (marked in blue on the left image) seems to contain remains of ejecta from a similar impact as the one described above (shown on the two images on the lefthand side)

However most of the ejecta of this impact is not visible anymore, either because it is located under the “sea level” of the “Sputnik Planum Ocean” now, or because it may have melted in the aftermath of the impact.

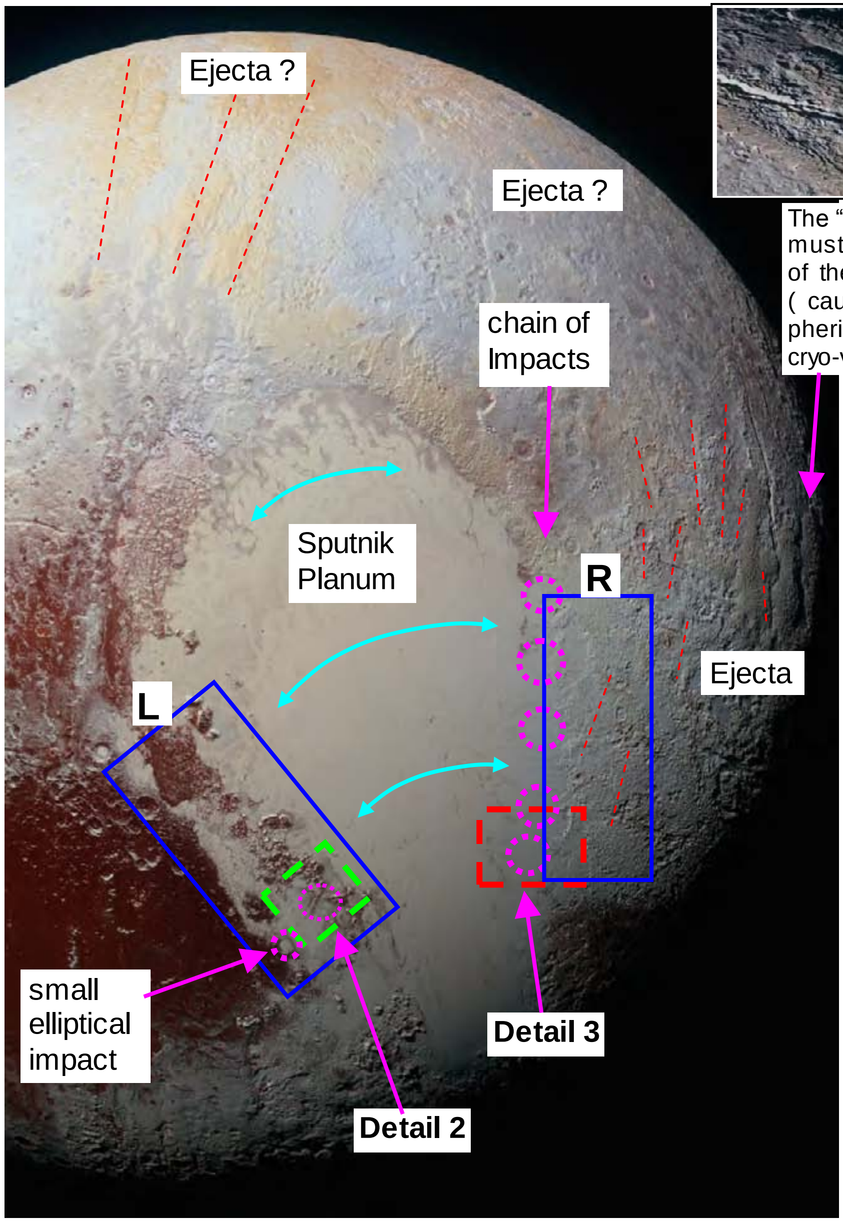
But it seems that there are more traces of this “impact crater” are visible on the other side of the “frozen Sputnik Planum Ocean” !!

→ See next page

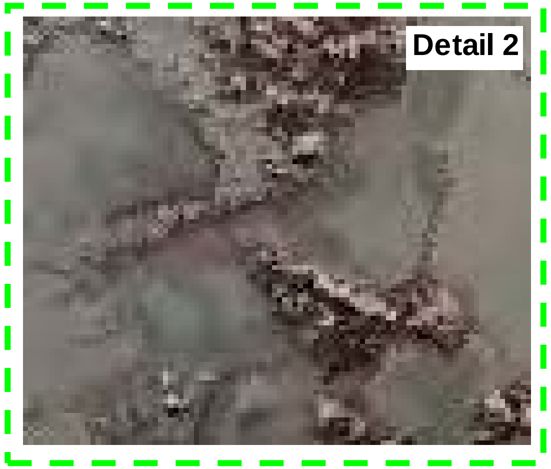

Detail 1
Remains of ejecta material from another now invisible Crater

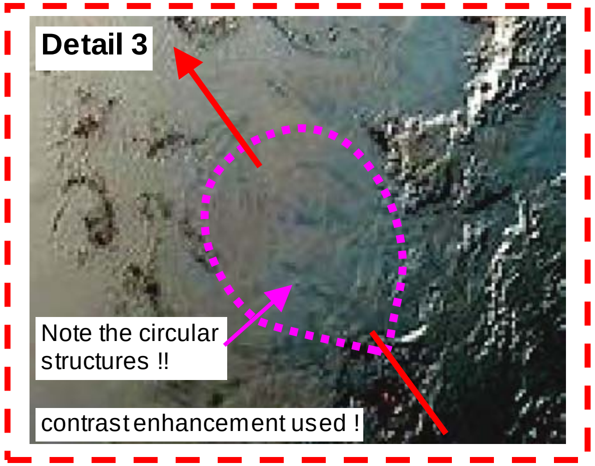
A chain of impacts seems to have caused a large fracture in Pluto’s crust, which then led to expansion tectonics

Along the linear sides in the East and West of Sputnik Planum there are structures visible which indicate the impact of several impactors. (the two linear sides are marked with blue boxes). On the west side (marked with L) the already mentioned small elliptical impact is visible. And on the east side (marked with R) structures are noticable which indicate **4 to 5 large impact craters with diameters in the range of ∅ 70 to ∅ 100 km.** These impact craters are all flooded and infilled with ice and only indirectly visible through circular structures in the ice (→ e.g. see Detail 3). It seems that these impact craters led to expansion tectonics which formed Sputnik Planum and led to the outflow of H_2O, N_2 and other volatiles from the mantle.



The “snakeskin area” must also be a result of the impact event. (caused by atmospheric flow or by cryo-volcanism)

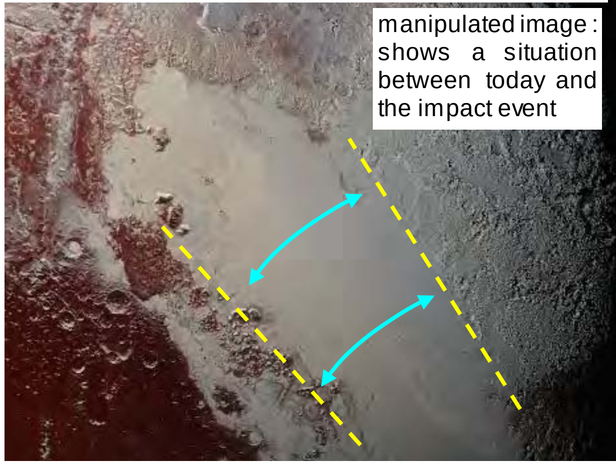




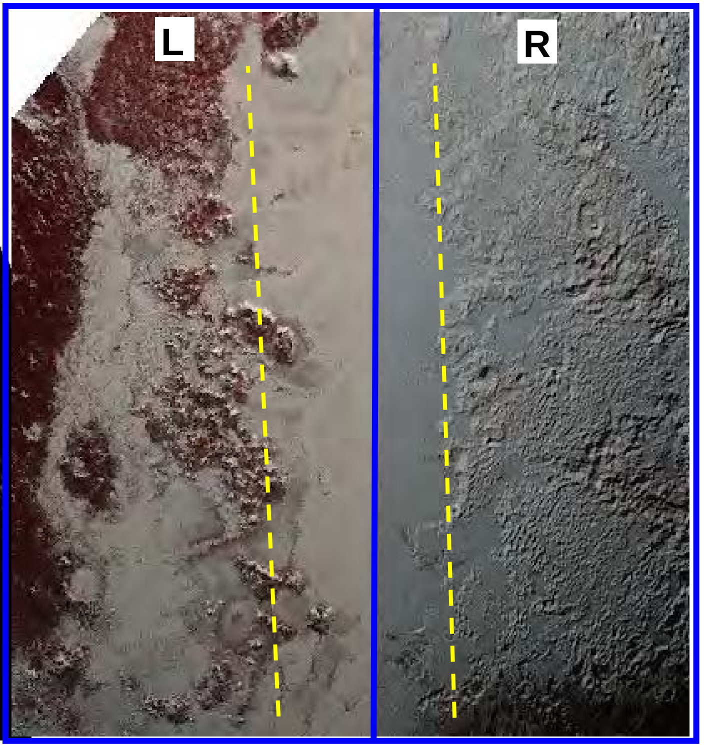
Note the circular structures !!

contrast enhancement used !

At the time of the impact the areas of detail 2 and detail 3 (or L & R) were one and the same area, before expansion tectonics set in and slowly moved the two sides (yellow lines) away from each other (see below !). Remains of the crater structure are only visible in detail 3. The slightly later formed small elliptical impact on the west site probably overprinted the remains of the larger crater indicated in detail 2 & 3.

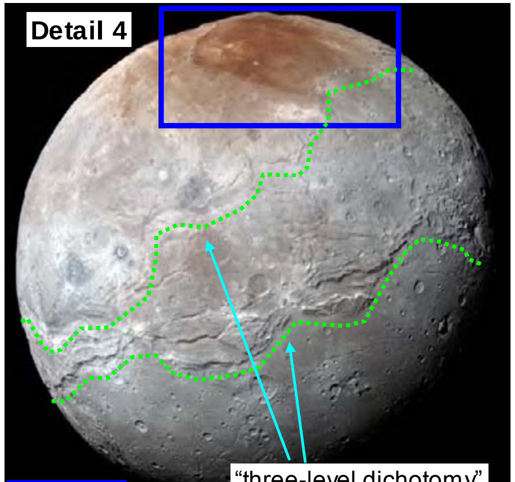


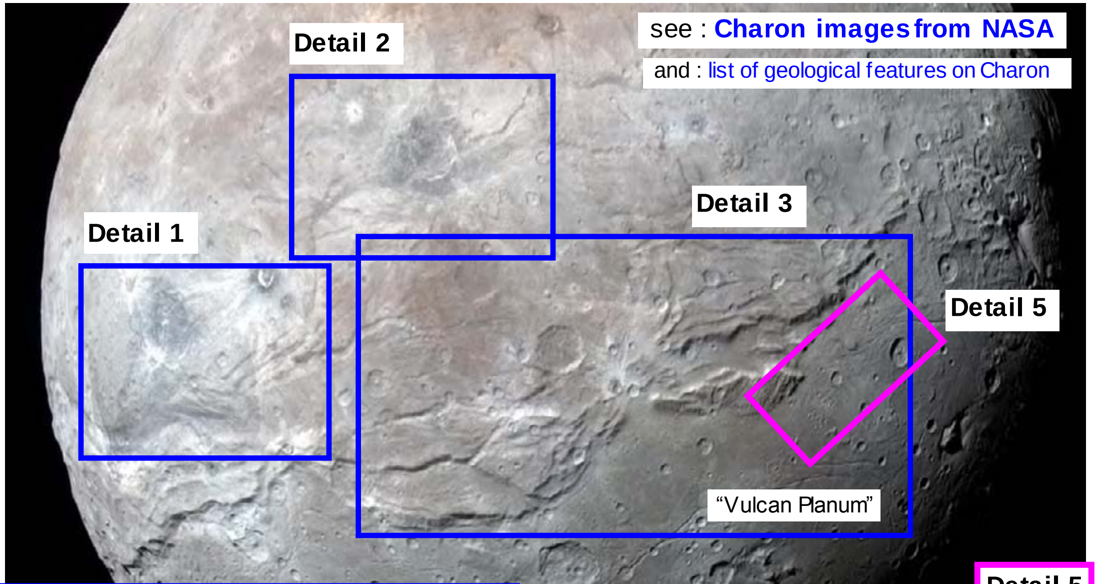
manipulated image : shows a situation between today and the impact event



9b The fracture belts on Charon are caused by Comet Impacts, which formed craters in the diameter range ∅ 60-110 km

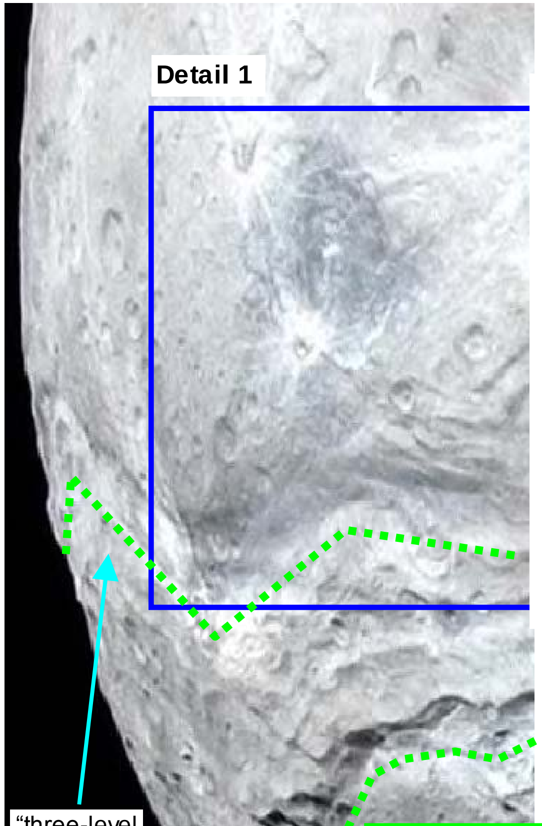
A number of large impact craters, probably caused by high velocity comets, are responsible for the fracturing of **Pluto Moon** Charon's crust. The cracks which resulted from these impacts not only caused the extensive canyon systems on Charon, they also triggered global expansion tectonics on Charon. There is a "three-level dichotomy" visible on Charon which probably was caused by two global impact events, which happened at different times.

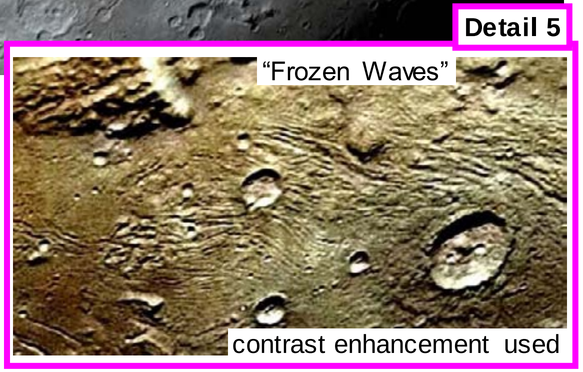


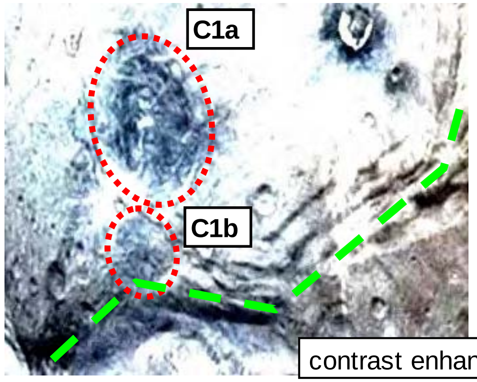


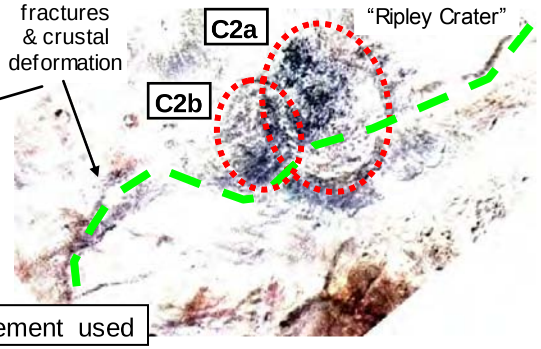
see : **Charon images from NASA**

and : list of geological features on Charon

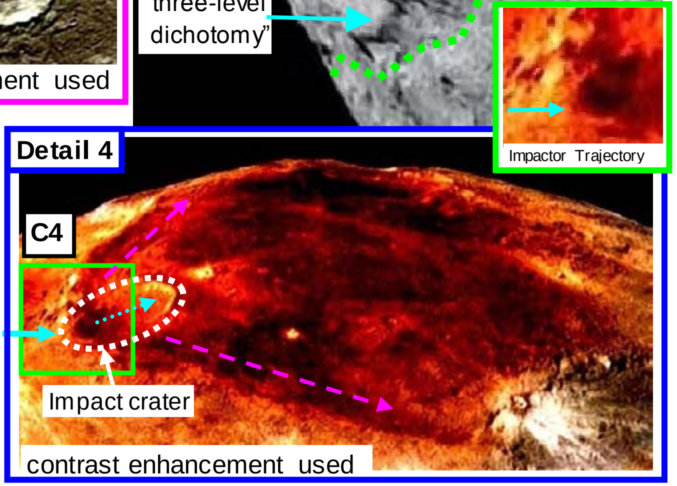






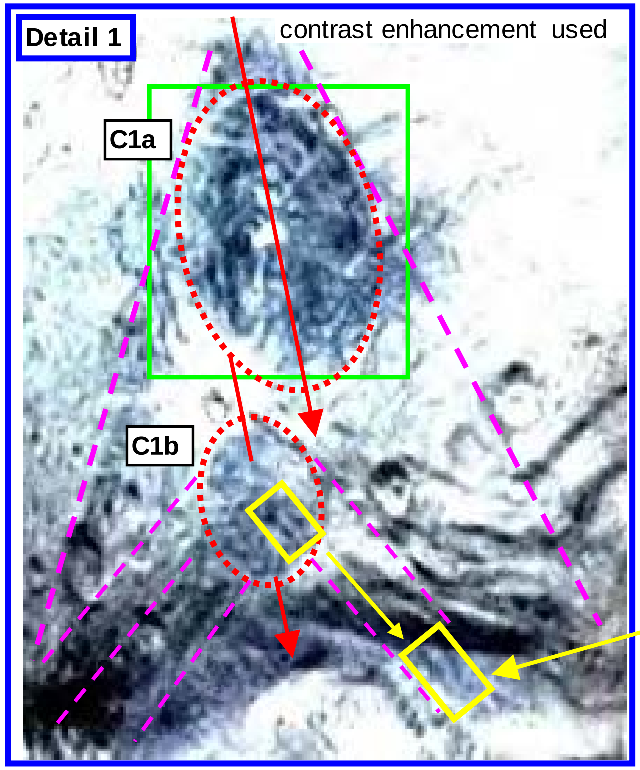


The Impact Craters visible in Details 1 & 2 were probably caused by comet fragments. These impacts are responsible for the fractures and the crustal deformation shown in the Details 1 & 2, which triggered global expansion tectonics and led to the "first dichotomy level". The dark surface markings in the north polar region are probably also the result of a big (carbon-rich) comet impact. See marks & description in Detail 4

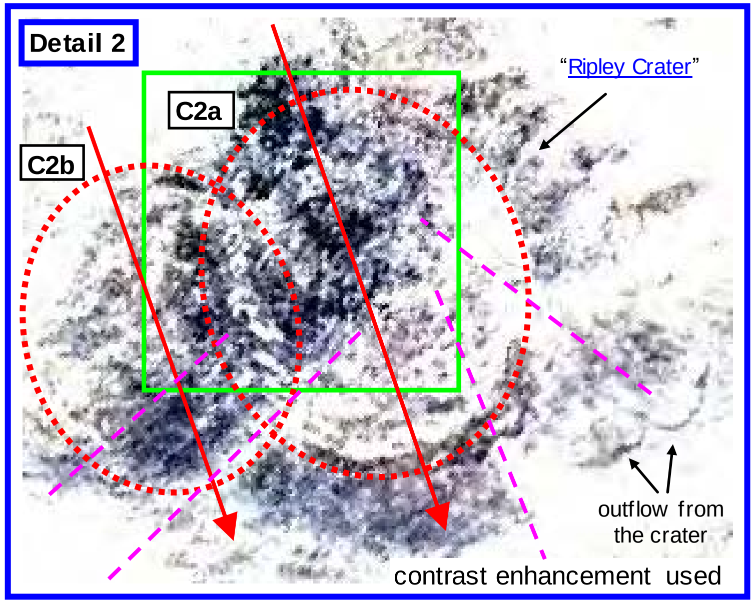


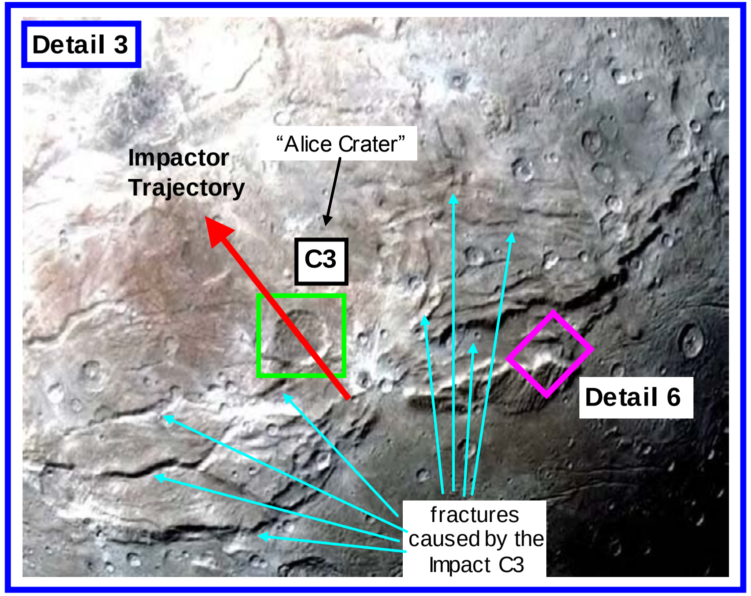
The "three-level-dichotomy" on Charon is a result of expansion tectonics, triggered by impact-induced fractures

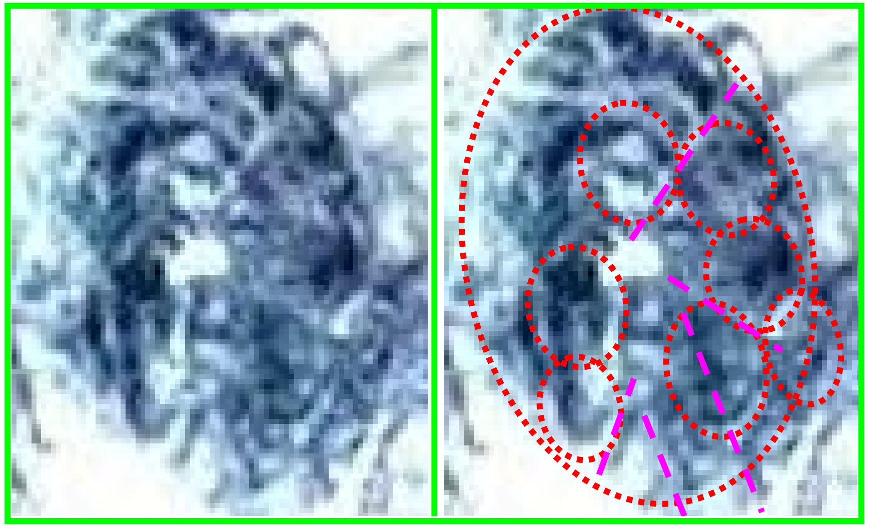
The "first dichotomy level" noticeable on Charon was caused by at least two simultaneous impact events which occured 350 km apart from each other Each of these two impact events not only produced two distinctive crater areas, which again were formed by several (> 10) (comet) fragments. It also caused extensive fractures and deformations in Charon's crust, which triggered global expansion tectonics and led to this "first dichotomy event".

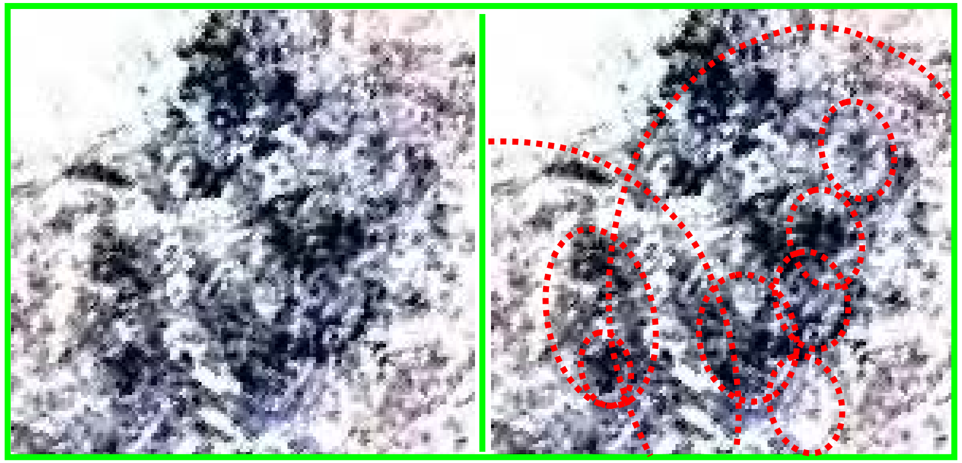


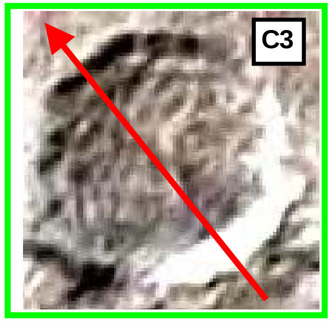
The two sections of the twin ejecta ray (→ yellow boxes) , belonging together, were separated by crustal deformation

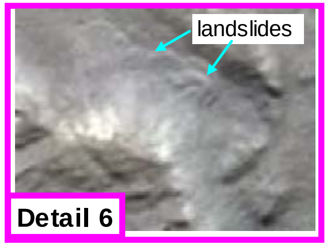












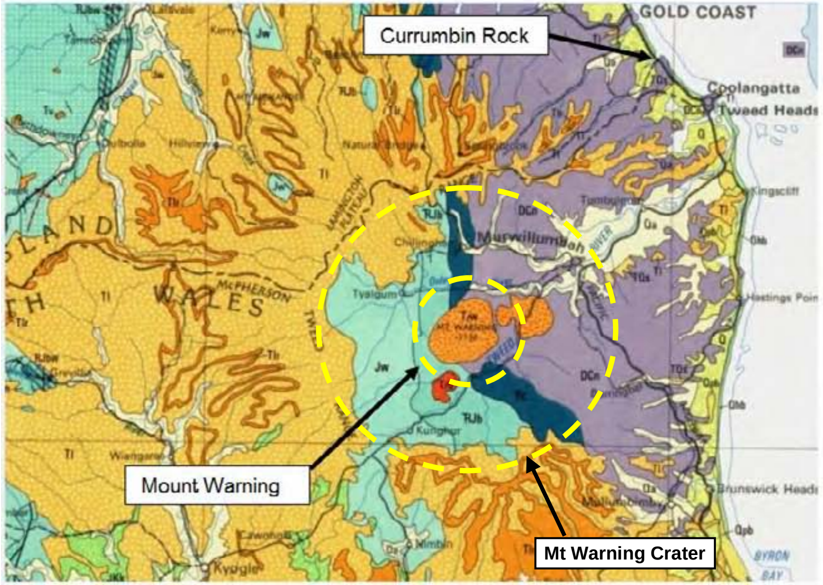
The "second dichotomy level" noticeable on Charon was also caused by at least one (or more) large Impact event(s) which led to another intensive episod of global expansion tectonics, which formed the young "Vulcan Planum" area on Charon.
Crater C3, which is probably also the result of a (burst) comet impact, is responsible for the majority of the fractures shown in Detail 3 ! This can be read from the fracture pattern and the trajectory of the comet which produced the impact crater (Alice Crater). The smooth Vulcan Planum is the result of expansion tectonics triggered by the fractrures, which brought large amounts of H_2O- & NH_3-rich material to the surface.

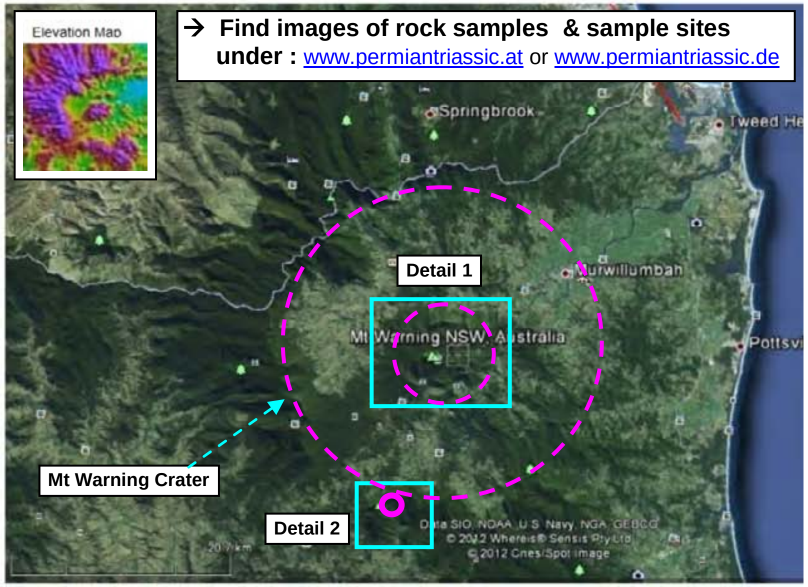
Detail 6 shows landslides probably caused by water-rich material, which probably was deposited by cryovolcanism.
A result of expansion textonics !

10 Secondary Impact crater with ∅ 30 km south of Brisbane / on East Coast of Australia

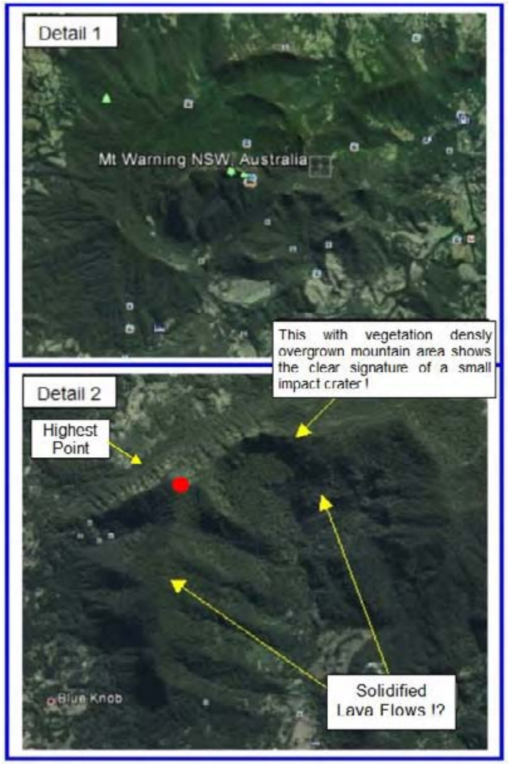
Prepared by Harry K. Hahn

Mount Warning is probably the result of a large secondary impact caused by the Cape York impact event, and is not the rest of an erroded shield-vulcano as currently believed ! Therefore the age of the Mt Warning crater should be ~ 253 Ma. The chaotic looking central area of the Mt Warning crater is probably the result of a central uplift where volcanic activity was going on inside (similar to a volcano). When the volcanic activity ended, this central uplift collapsed into a chaotic structure.





→ **Find images of rock samples & sample sites under :** www.permiantriassic.at or www.permiantriassic.de

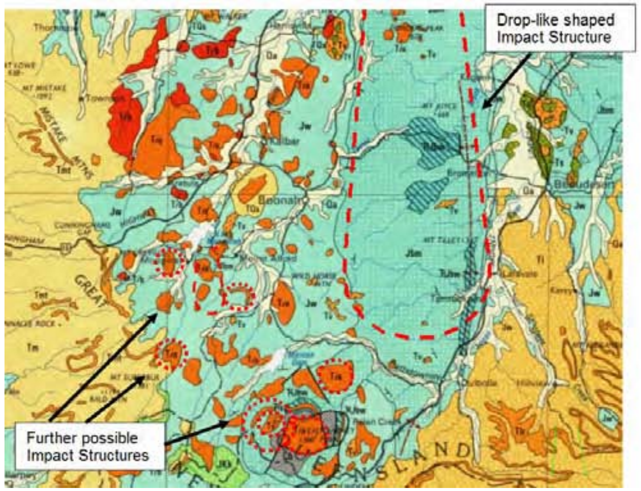


This with vegetation densly overgrown mountain area shows the clear signature of a small impact crater !

Further secondary impact structures north-west of Mt. Warning :

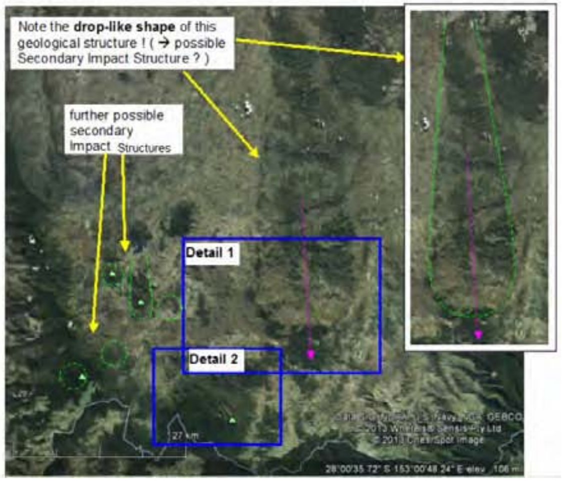
Map : **Moreton Geology :** →
Geology Maps → type in : **WARWICK**

North-West of Mount Warning there are further structures which also seem to be secondary impact structures which are caused by the Cape York impact event. These impact structures probably also formed 253 Ma ago, at the P-Tr boundary



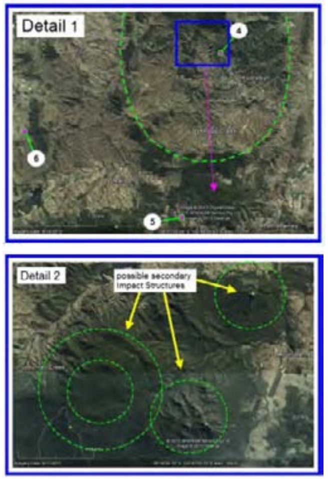
Drop-like shaped Impact Structure

Further possible Impact Structures

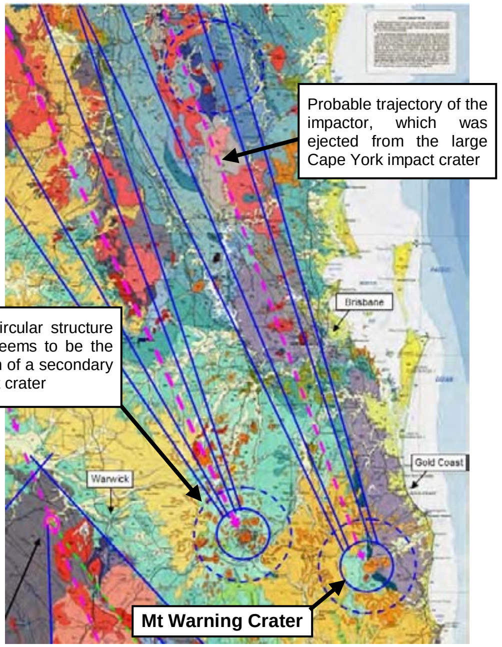


Note the **drop-like shape** of this geological structure ! (→ possible Secondary Impact Structure ?)

further possible secondary impact Structures



possible secondary impact Structures



Probable trajectory of the impactor, which was ejected from the large Cape York impact crater

This circular structure also seems to be the remain of a secondary impact crater

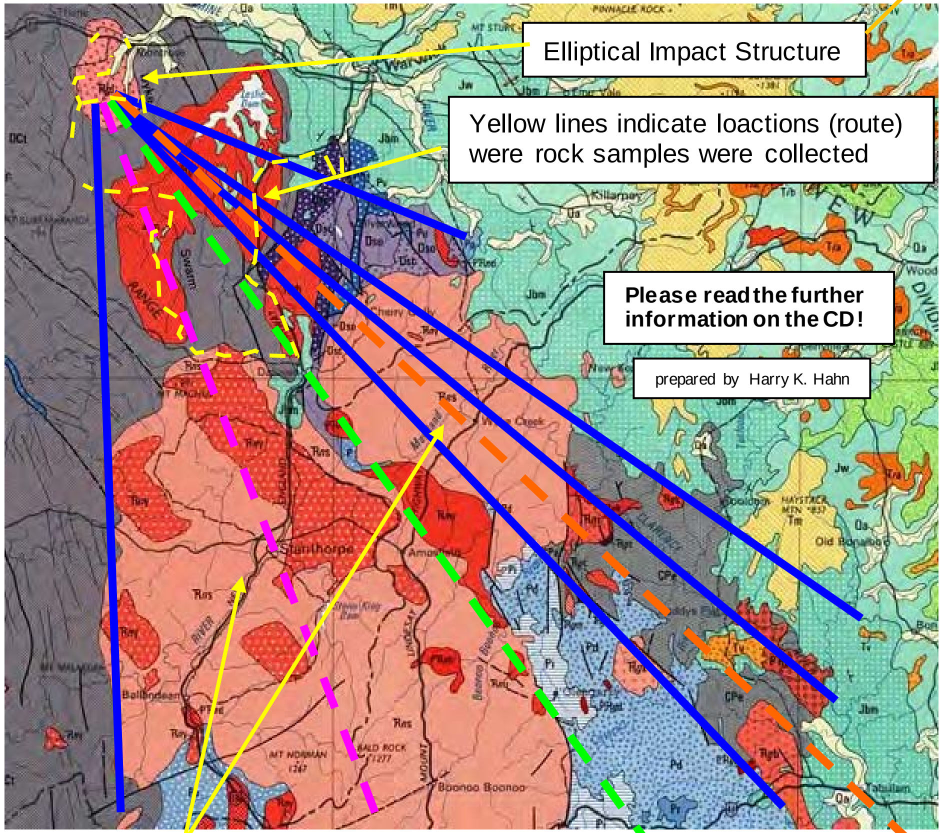
11 Oblique Impact Structure near Warwick / Queensland

There is a precise elliptical ring structure noticable on the shown Magnetic Intensity Map. This structure is located around 30km west of Warwick (QLD). This elliptical ring structure is not completely closed, which is an indication that the impactor arrived in a shallow angle.

The orientation of the elliptical ring structure corresponds with the orientation of the (assumed) ejecta blanket. The age of the oblique impact is probably 253 Ma. (see explanation in this study)

The geological map of the surrounding area shows a very striking distribution of certain rock types along sectors, which are limited by „rays“, which all seem to come from the same starting point. And it seems that all rays have their starting point within the elliptical impact structure !
Only the rays which limit the sector of the grey colored rock type (see next page !) seem to have their starting point shifted a bit towards the direction where the impactor came from.
That’s why it can be assumed that the pink & red colored rock types, and also the grey colored rock type, were scattered during the impact towards the south-east, in a cone-shaped pattern.

„Ejecta Blanket“ & Geological Map of the surrounding area of the Impact Structure



Elliptical Impact Structure

Yellow lines indicate loactions (route) were rock samples were collected

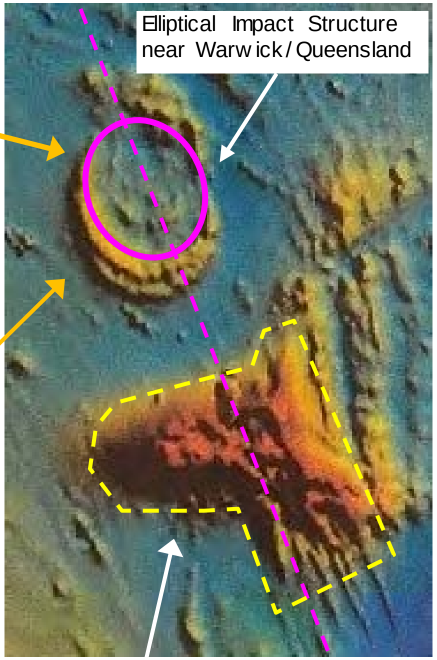
Please read the further information on the CD!

prepared by Harry K. Hahn

ejecta blanket of the elliptical impact structure

main impact direction

→ **Find images of rock samples & sample sites under :** www.permiantriassic.at or www.permiantriassic.de



Elliptical Impact Structure near Warwick / Queensland

magnetic signature of ejected material

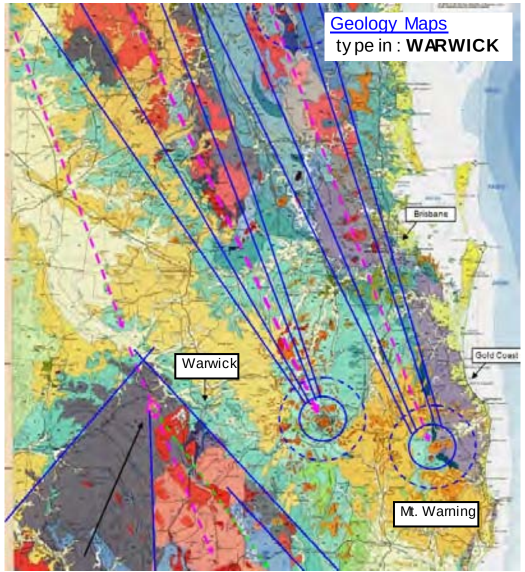
main impact direction

The image below shows the geological map of the wider surrounding area of the assumed Impact Event near the city „Warwick“. Beside the cone-shaped distribution of the different rock types south of the elliptical Impact Structure near Warwick, there is also a striking stripe-like (or ray-like) distribution visible of similar colored rock types, parallel to the suggested “main impact direction”. Here the main impact direction corresponds to the direction of the pink arrow in the first image on the previous page.

And at the end of the two visible “stripe-like (or ray-like) “ejecta blankets” there are circular geological structures noticeable.

With high probability these circular geological structures are also the remains of secondary craters, which were caused by material ejected from the primary (Cape York) impact crater further north ! I now want to examine one of these circular structures a bit closer. This geological structure is named “Mount Warning”

Map :
Moreton Geology :

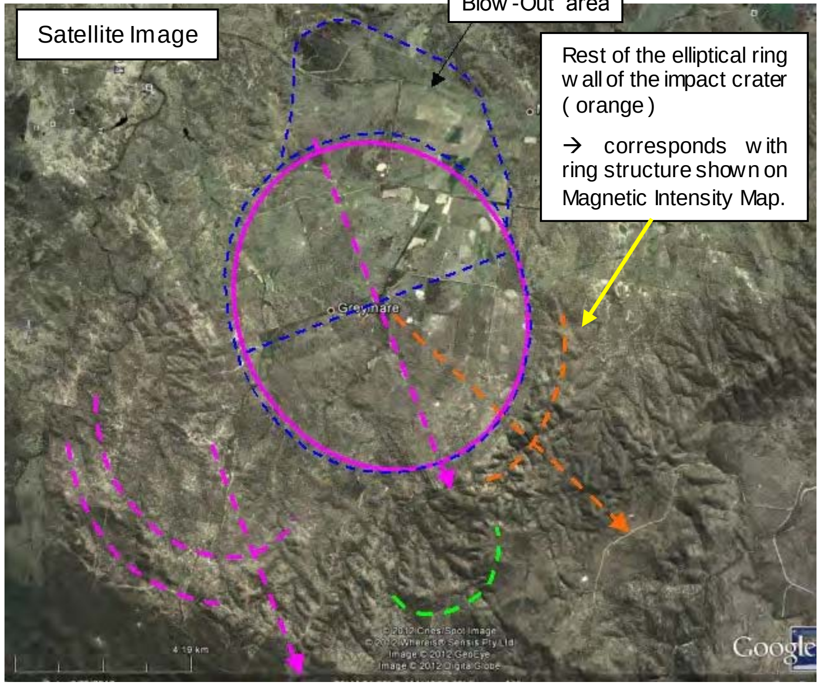


Geology Maps
type in : **WARWICK**

Warwick

Mt. Warning

“Blow -Out” area



Satellite Image

Rest of the elliptical ring wall of the impact crater (orange)

→ corresponds with ring structure shown on Magnetic Intensity Map.

I have marked the form of the assumed impact structure (as shown on Magnetic Intensity Map) in this satellite image.

Dimensions of the small elliptical impact structure approx. : **8 x 7 km**.

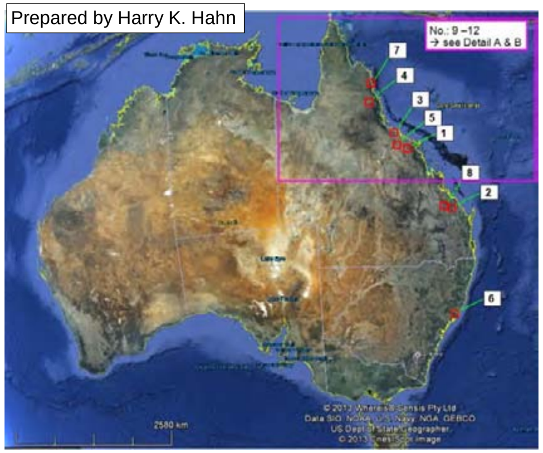
The age is probably 253 million years. (PT-I)

The scattered rock types give indication that this small secondary impact structure, together with the Cape York Crater is connected to the largest mass extinction in Earth’s history, at the Permian-Triassic boundary

12

Further secondary impact structures (caused by the Cape York impact event) in the eastern part of Australia.

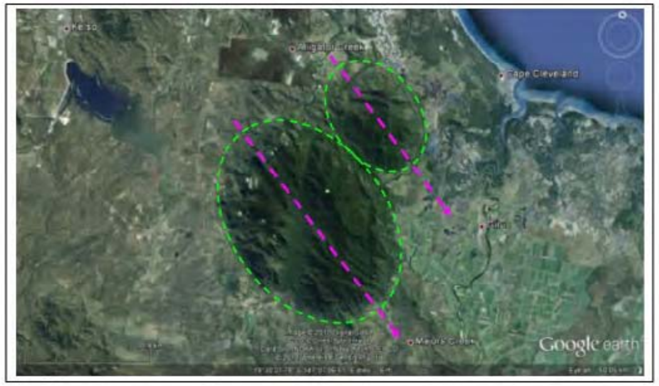
The following maps show where further secondary impact structures are located, near the east coast of Australia. Most of the identified impact structures which are a result of the Cape York impact, have an elliptical shape and the impact direction can easily be read out of the topography.


Prepared by Harry K. Hahn

No.: 9 –12
→ see Detail A & B

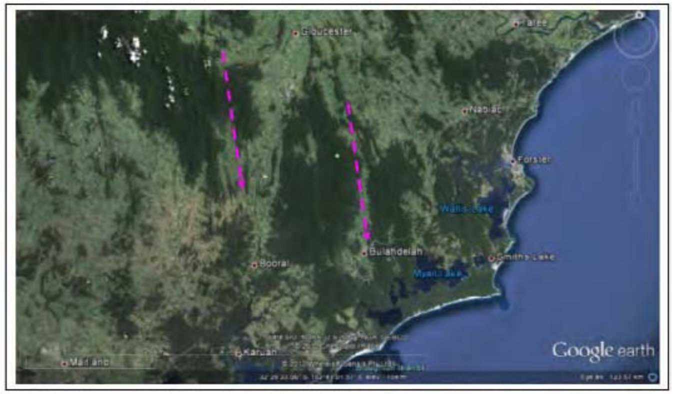
3

19° 28' 00.00" S - 147° 00' 00.00" E



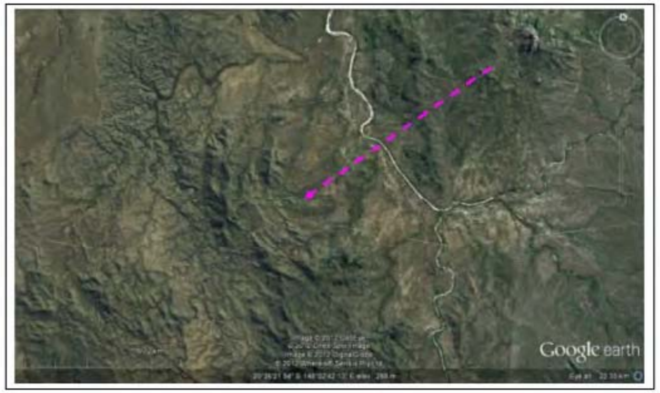
6

32° 15' 00.00" S - 152° 10' 00.00" E



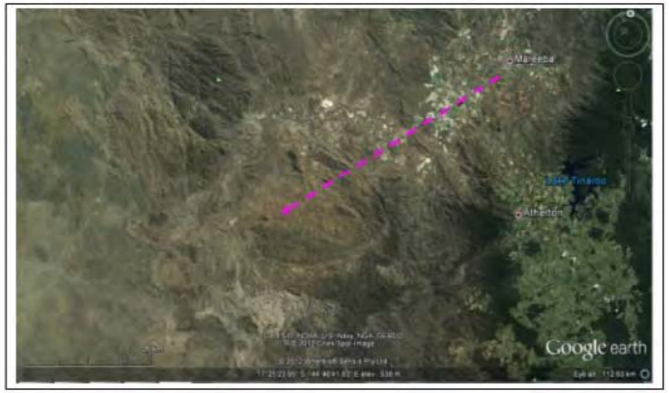
1

20° 25' 00.00" S - 148° 06' 00.00" E



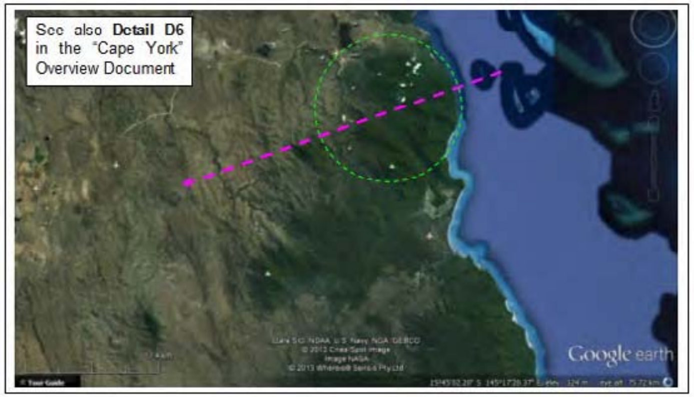
4

17° 20' 00.00" S 145° 00' 00.00" E



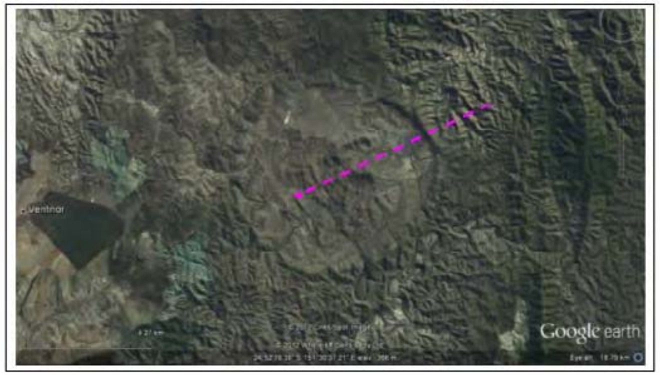
7

15° 45' 00.00" S - 145° 18' 00.00" E


See also **Detail D6** in the "Cape York" Overview Document

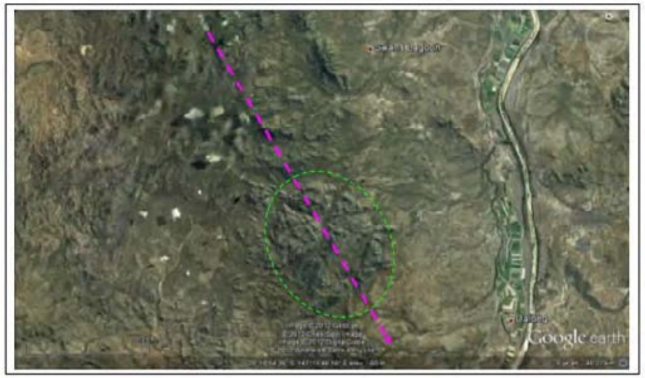
2

24° 52' 00.00" S - 151° 25' 00.00" E



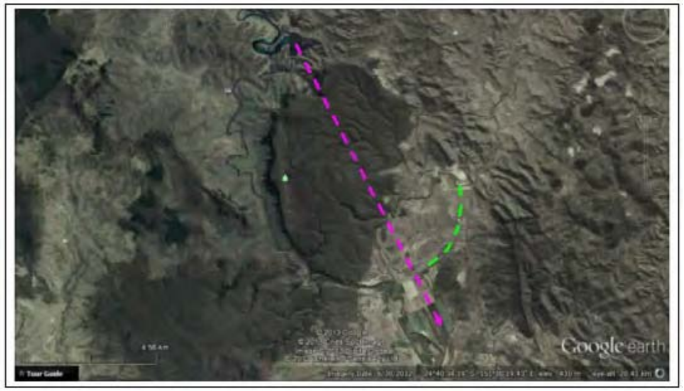
5

20° 12' 00.00" S - 147° 09' 00.00" E



8

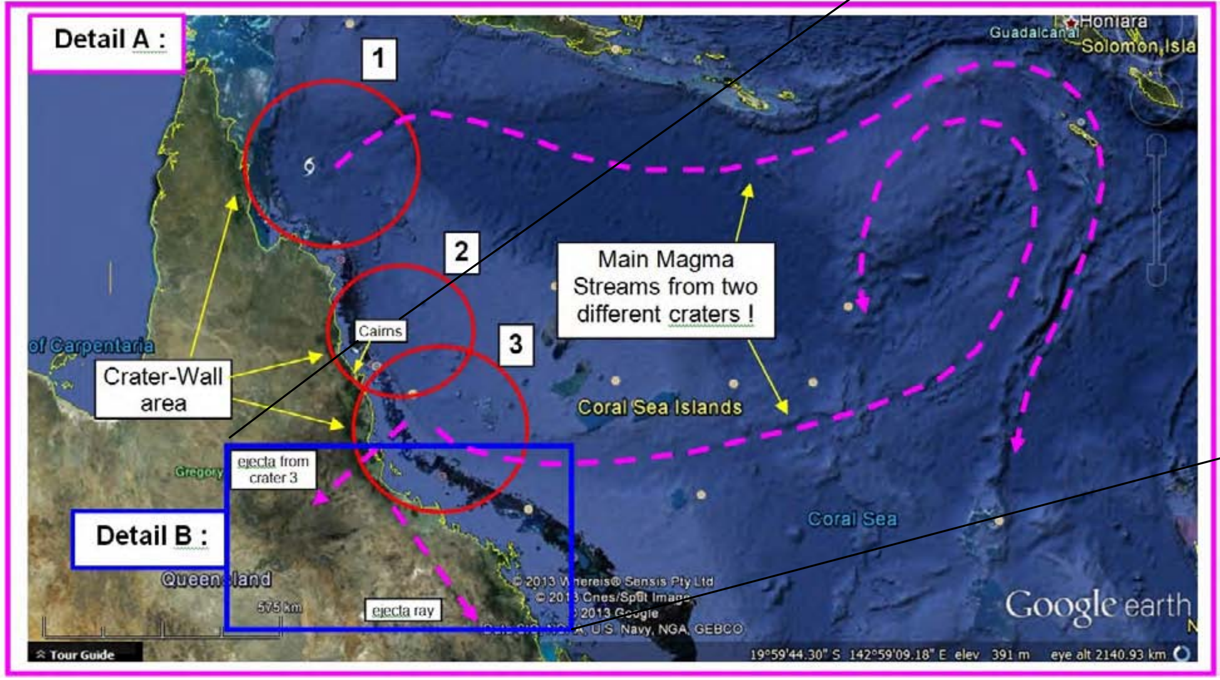
24° 40' 00.00" S - 151° 00' 00.00" E

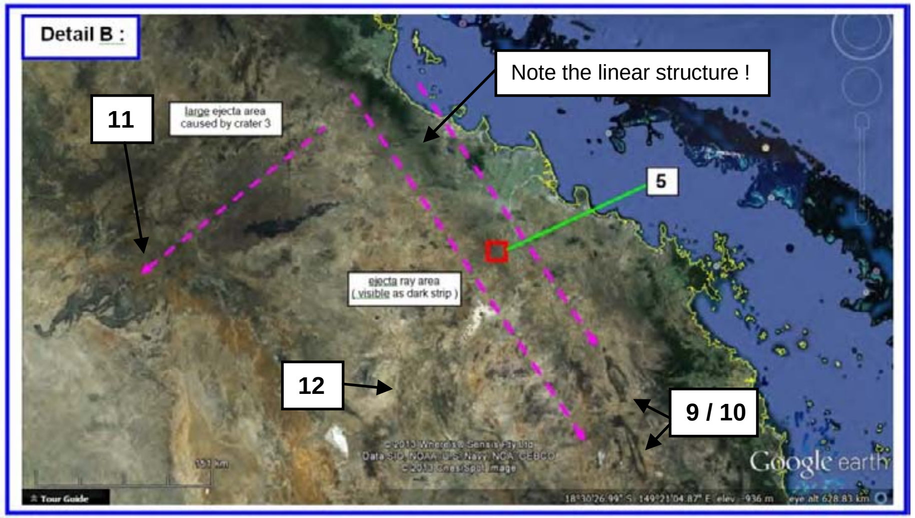


Detail A & B : No.: 9 –12 :

→ **Scenario 2 : → Secondary Impact Structures are caused by ≥ 3 Impact Craters !!**

Detail A shows : the probable positions of three impact craters which may be responsible for the assumed large impact event off-shore of the north-east coast of Australia, and magma streams caused by two of these craters. Detail B shows some secondary impact structures caused by the craters 1 to 3.

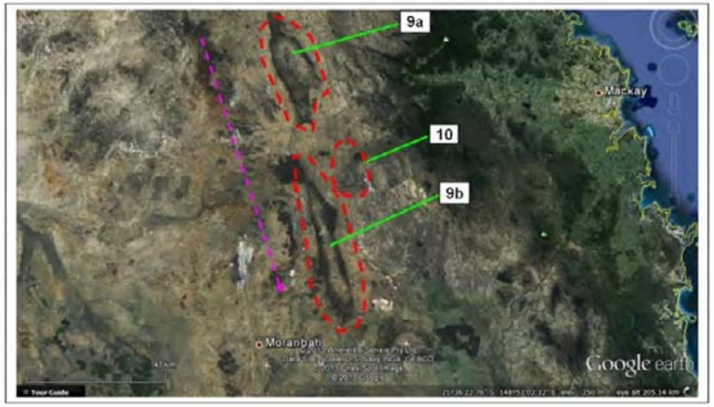



Detail B :
Note the linear structure !
11
large ejecta area caused by crater 3
5
ejecta ray area (visible as dark strip)
12
9 / 10
© 2013 Whereis® Sensis Pty Ltd
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Cnes/Spot Image
Google earth
Tour Guide
18°30'26.99" S 149°21'04.87" E elev 936 m eye alt 628.83 km

9a & 9b

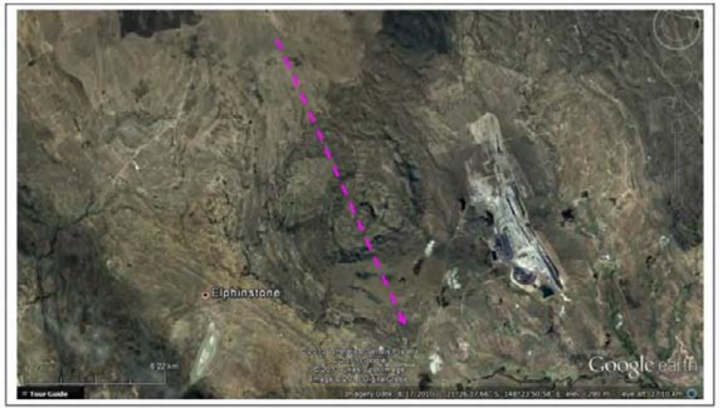
9a : 21° 06' 00.00" S - 148° 05' 00.00" E

9b : 21° 45' 00.00" S - 148° 16' 00.00" E



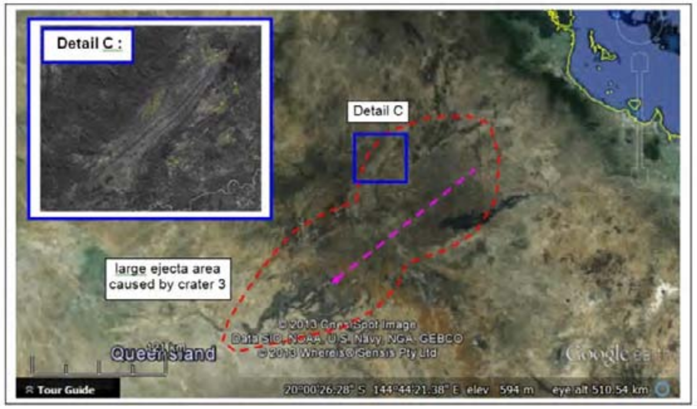
10

21° 28' 00.00" S - 148° 19' 00.00" E



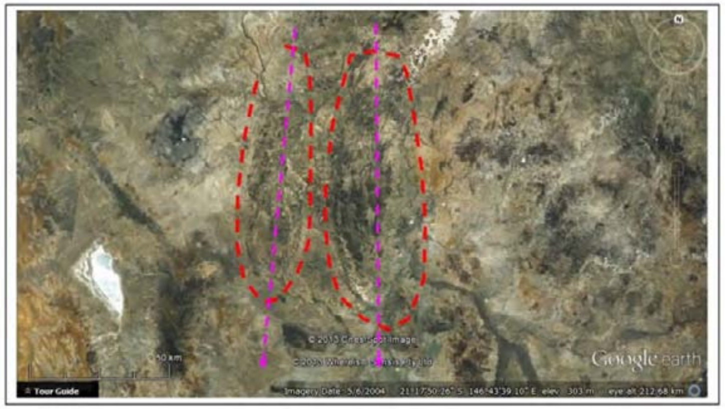
11

20° 00' 00.00" S - 144° 40' 00.00" E


Detail C :
Detail C
large ejecta area caused by crater 3
Queensland
© 2013 Cnes/Spot Image
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Whereis® Sensis Pty Ltd
Google earth
Tour Guide
20°00'26.28" S 144°44'21.38" E elev 594 m eye alt 510.54 km

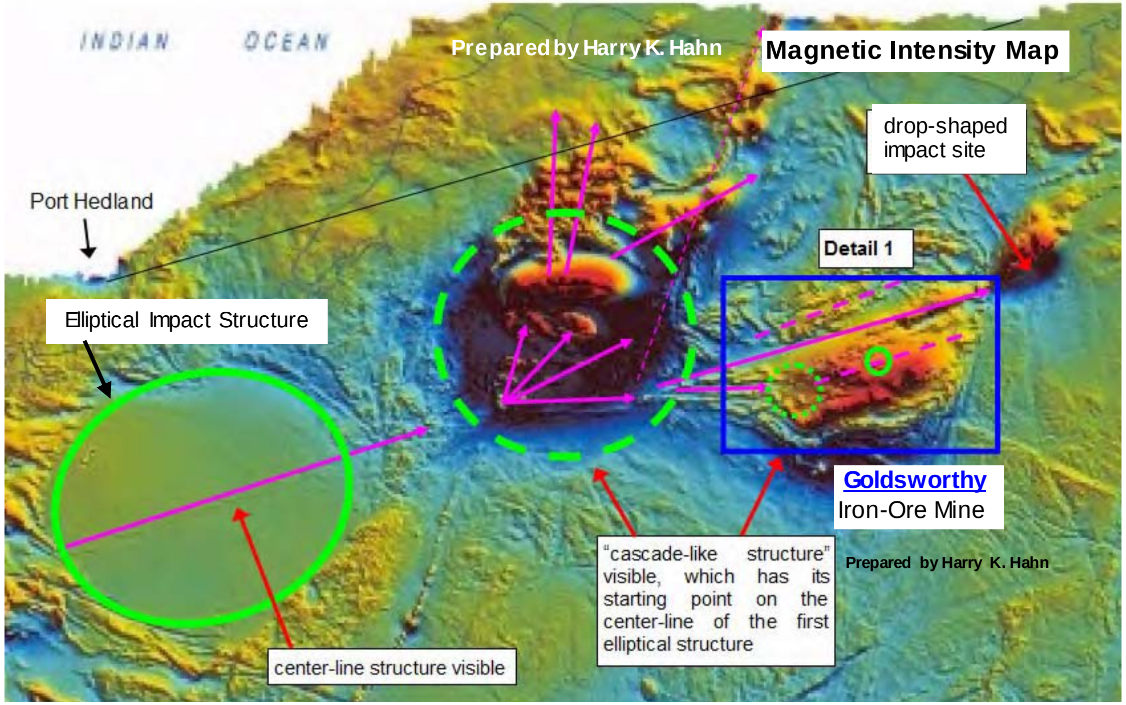
12

21° 25' 00.00" S - 146° 26' 00.00" E



13 Complex Impact Structure (> ∅30 km Crater) near Port Hedland in the Pilbara Region (in NW of West-Australia)

The satellite view, the magnetic intensity map and the geological map indicate a complex impact structure near Port Headland (in West-Australia), which probably was formed by secondary impactors ejected by a large asteroid impact crater further away. This impact structure must be > 200 Million years old.

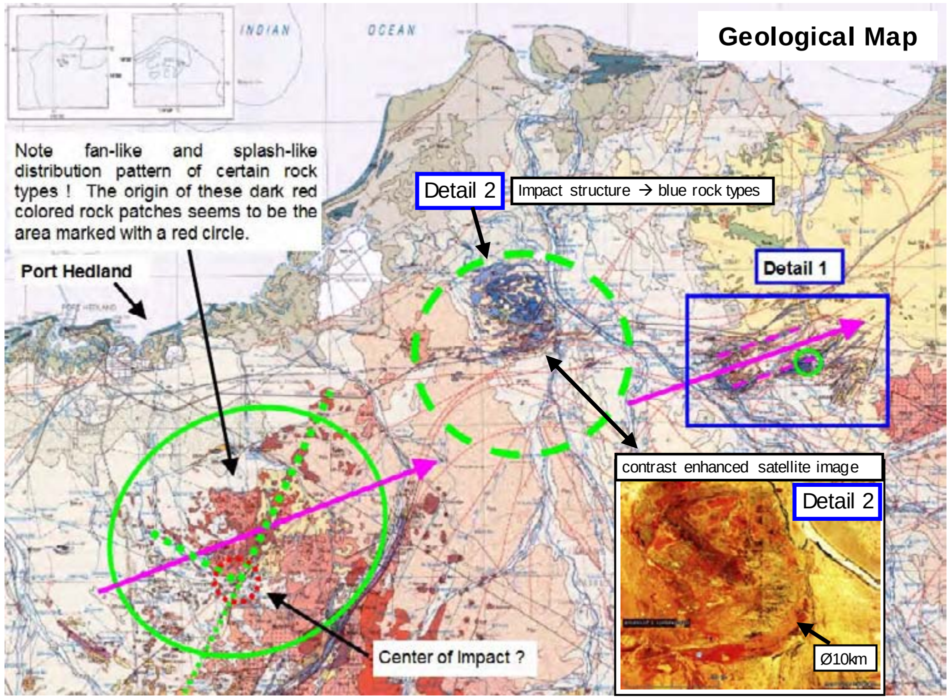


Magnetic Intensity Map

Prepared by Harry K. Hahn

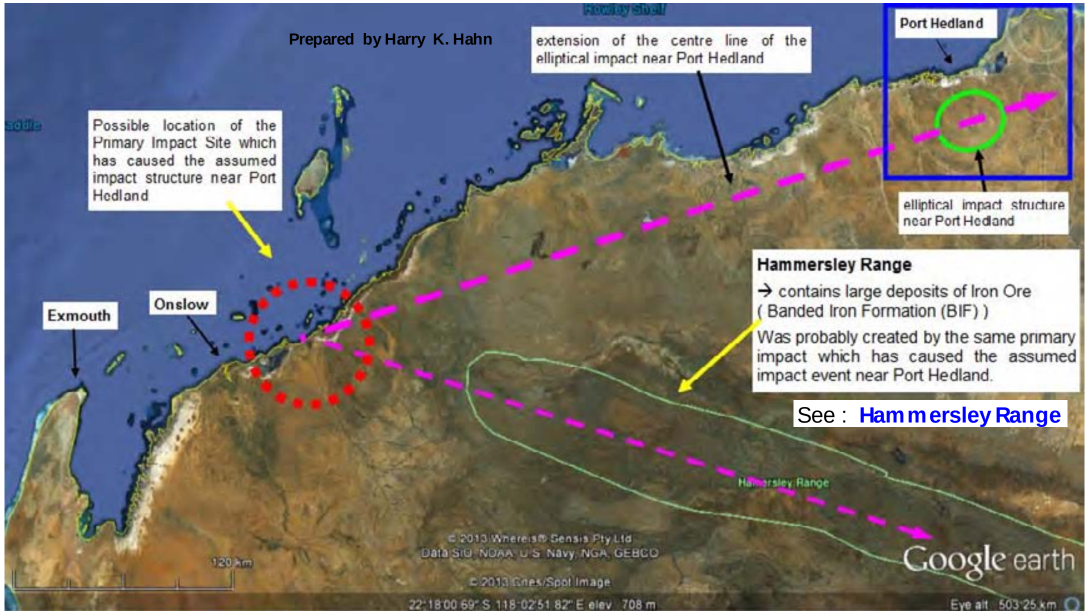
“cascade-like structure” visible, which has its starting point on the center-line of the first elliptical structure

INDIAN OCEAN
Port Hedland
Elliptical Impact Structure
drop-shaped impact site
Detail 1
Goldsworthy
Iron-Ore Mine
center-line structure visible
Prepared by Harry K. Hahn



Geological Map

Note fan-like and splash-like distribution pattern of certain rock types ! The origin of these dark red colored rock patches seems to be the area marked with a red circle.



Possible location of the Primary Impact Site which has caused the assumed impact structure near Port Hedland

extension of the centre line of the elliptical impact near Port Hedland

Hammersley Range

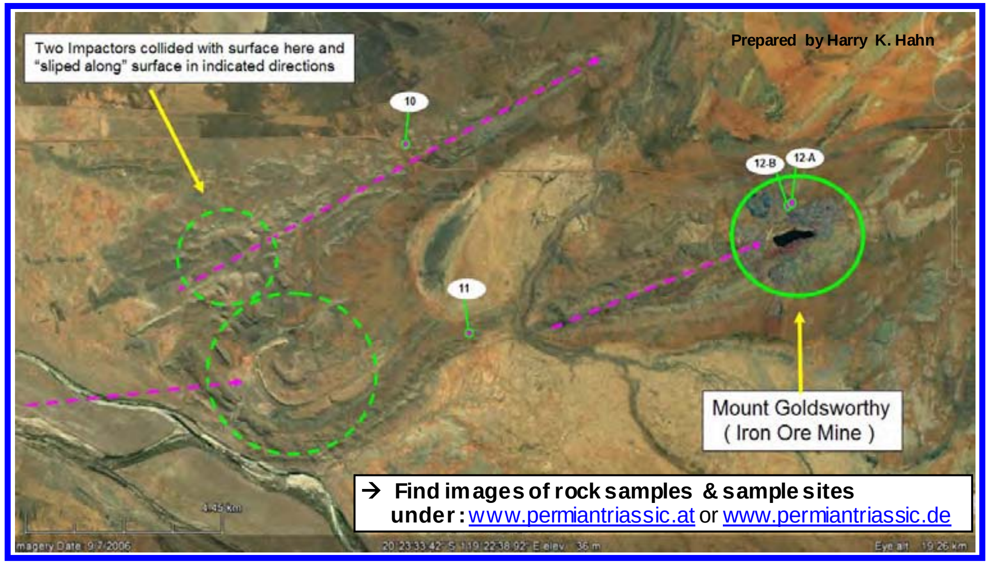
→ contains large deposits of Iron Ore (Banded Iron Formation (BIF))

Was probably created by the same primary impact which has caused the assumed impact event near Port Hedland.

See : **Hammersley Range**

Prepared by Harry K. Hahn
Port Hedland
elliptical impact structure near Port Hedland
Exmouth
Onslow
Hamersley Range
Google earth
© 2013 Whereis® Sensis Pty Ltd
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Cnes/Spot Image
120 km
22°18'00.69" S 118°02'51.82" E elev 708 m
Eye alt 503.25 km

Detail 1 : Satellite View with marked position of impactor sites & Iron Ore Mine

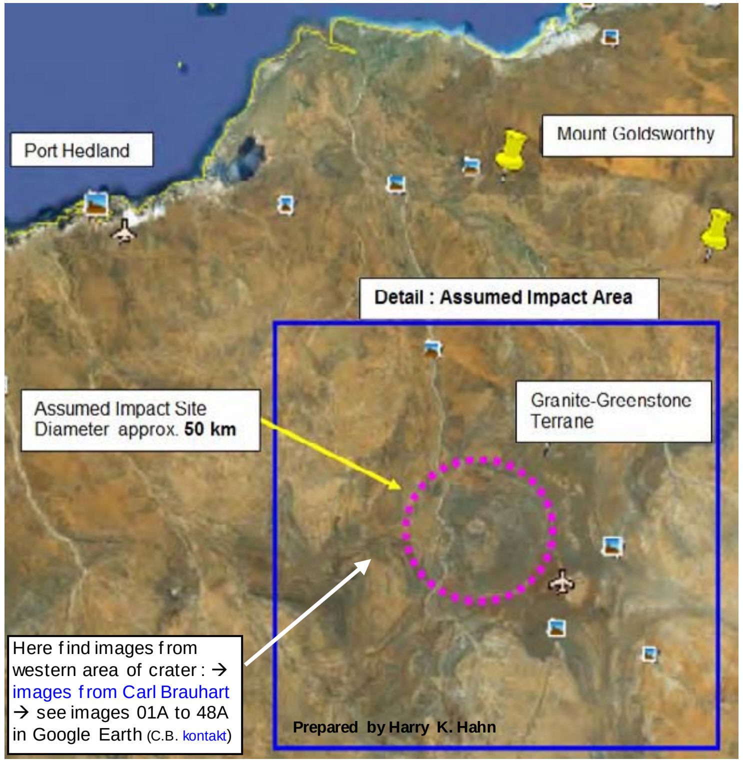


Two Impactors collided with surface here and “sliped along” surface in indicated directions

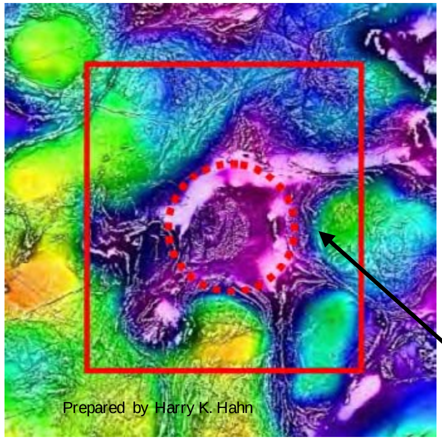
→ **Find images of rock samples & sample sites under : www.permiantriassic.at or www.permiantriassic.de**

14 Primary Impact Crater ∅ 50 km (age > 3 Ga) in the Pilbara Region near Marble Bar / Western Australia

The satellite view, the magnetic intensity map and the geological map indicate a very old ∅ 50 km impact structure near Marble Bar / Western Australia. These impact structure probably was formed by a comet fragment which impacted on the indicated position approx. 3,25 Ga ago. This impact event may be connected to the BGB impact structure in South-Africa, and it maybe responsible for the development of the first life-forms on Earth ~ 3,25 Ga ago !

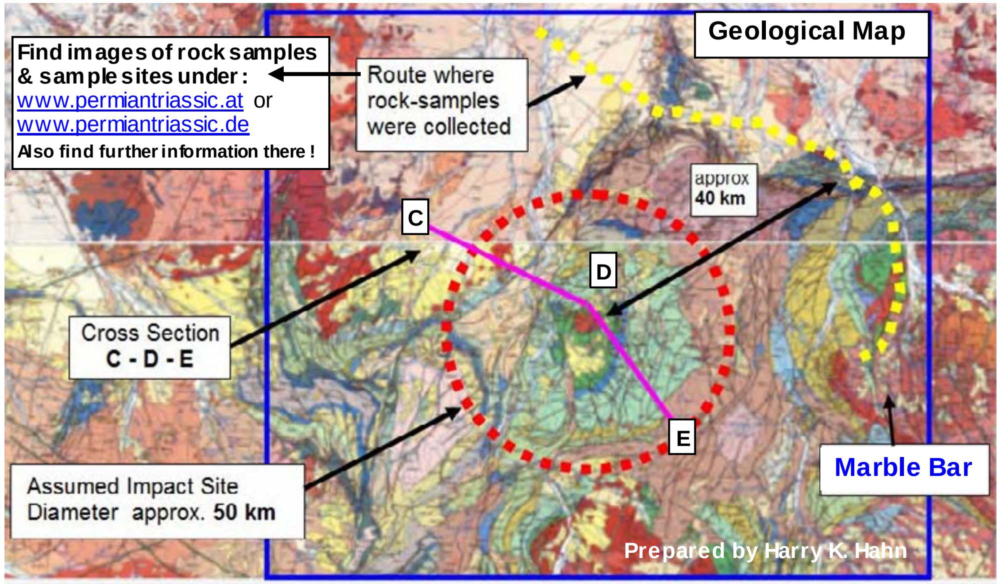


Here find images from western area of crater : → images from Carl Brauhart → see images 01A to 48A in Google Earth (C.B. kontakt)



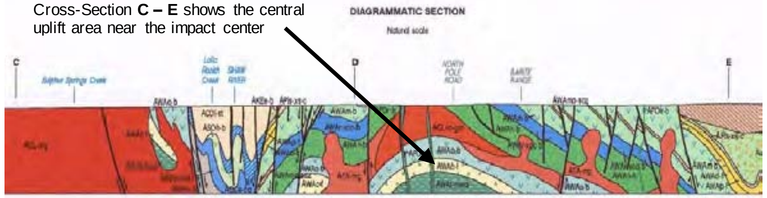
Combined magnetic intensity (first vertical derivative) and gravity image of the Eastern Pilbara Granite-Greenstone Terrain (R.Blewett, National Geoscience Mapping Accord, AGSO-Geoscience Australia). The image shows the distinct ovoid outline of the granitoid complexes, surrounded by greenstone belts

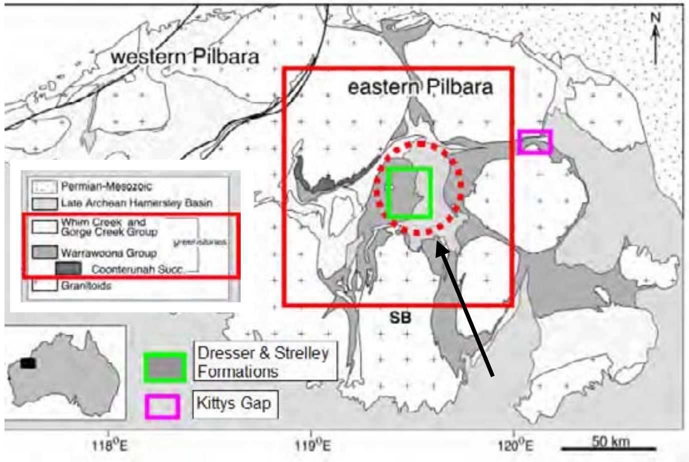
∅ 50 km impact structure



Find images of rock samples & sample sites under : www.permiantriassic.at or www.permiantriassic.de
Also find further information there !

Cross-Section **C – E** shows the central uplift area near the impact center





The Geologist Andrew Y. Glikson pointed out, that there seems to be a clear correlation between the **BGB 3.26 – 3.24 Ga impact event** in South-Africa and stratigraphic units of the same age in the Pilbara Craton (→ **the assumed impact event described in this document)**

Therefore I want to propose the following hypothesis :

Both impact events, the BGB impact structure and this impact event in the Pilbaras occurred at the same time ! These impacts were caused by the same impactor, which probably was a comet, maybe coming from the Oort Cloud, which broke apart when it reached the roche limit (approx. 10000 to 30000 km above Earth's surface).

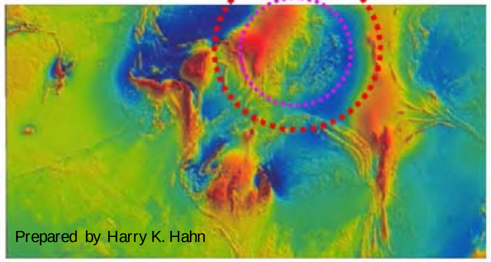
The fragments of the comet then formed the BGB structure and the described Pilbara impact structure.

The later development of the **oldest known** Stromatolites, found very close to the two impact sites, was a direct result of these two impacts and the organic material which arrived together with the impacting comet fragments

The oldest 3.25 Ga Stromatolites are found in the Hooggenoeg Formation (Buck Ridge) / South Africa and in the Dresser Formation / West Australia, **less than 30 km** away from each of the two impact sites ! There is also strong indication that the Pilbara Craton and the BGB formed the first Supercontinent Vaalbara ~ **3.25 Ga ago**.

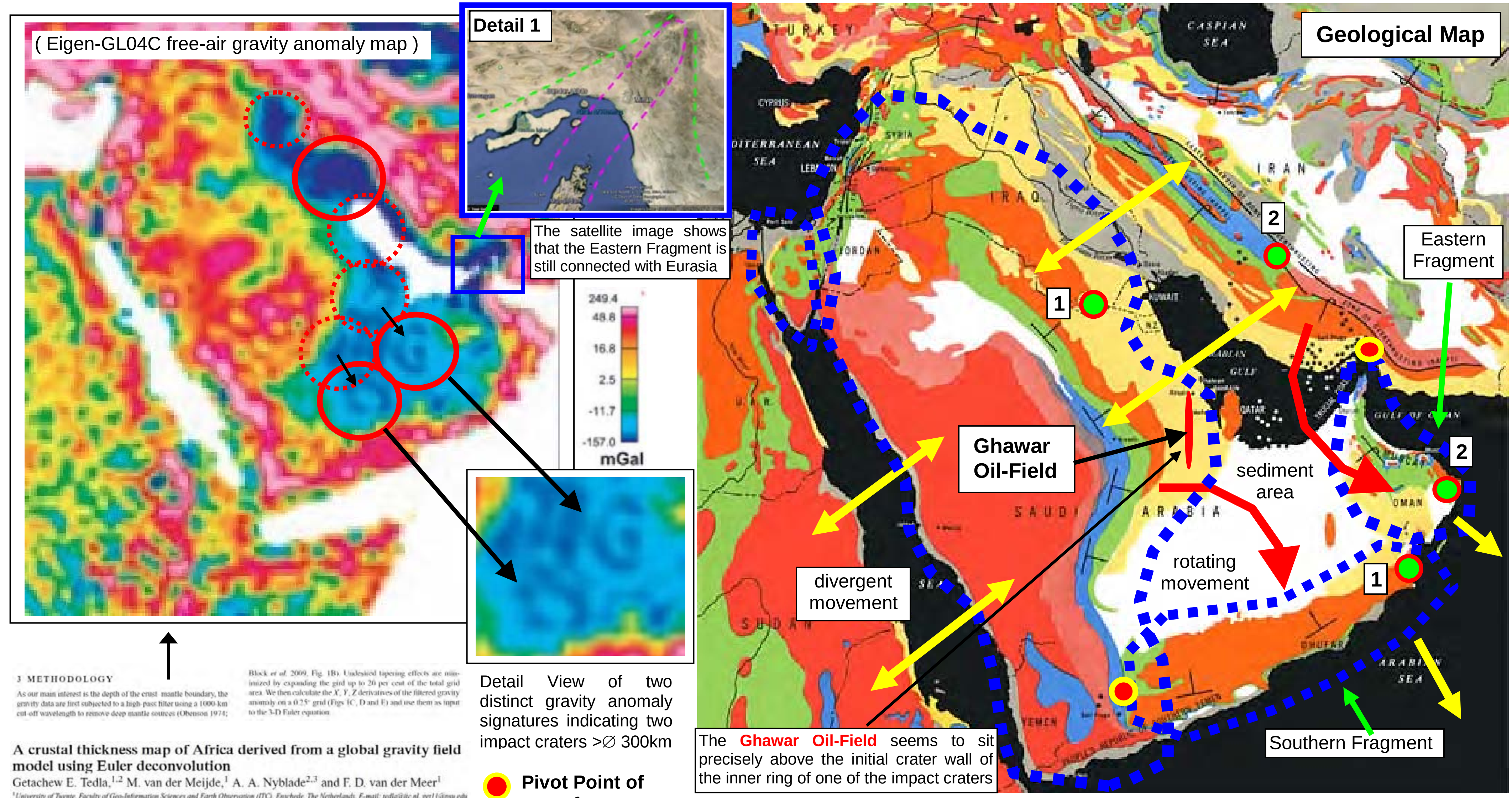
Note **circular pattern** with inner ring structure and uplift area in assumed impact (crater) zone

Total Magnetic Intensity



15 Arabia was formed by several impact craters (∅ 300-400 km), probably caused by ejecta from the PT-Impact Crater

The gravity anomaly map of Arabia indicates at least three circular structures, probably secondary craters from the PT-Impact 253 Ma ago, which caused extensive fractures and led to expansion tectonics in the area of Arabia. The impact impulse resulting from this impact event caused a divergent movement of three crust fragments, which eventually formed the arabian peninsula and with it the rich Oil- and Gas-Fields in the area of Saudi Arabia.



(Eigen-GL04C free-air gravity anomaly map)

Detail 1

The satellite image shows that the Eastern Fragment is still connected with Eurasia

Detail View of two distinct gravity anomaly signatures indicating two impact craters >∅ 300km

Geological Map

Eastern Fragment

Ghawar Oil-Field

sediment area

rotating movement

divergent movement

Southern Fragment

The **Ghawar Oil-Field** seems to sit precisely above the initial crater wall of the inner ring of one of the impact craters

3 METHODOLOGY

As our main interest is the depth of the crust mantle boundary, the gravity data are first subjected to a high-pass filter using a 1000-km cut-off wavelength to remove deep mantle sources (Obenson 1974; Block *et al.* 2009, Fig. 1B). Undesired tapering effects are minimized by expanding the grid up to 20 per cent of the total grid area. We then calculate the *X*, *Y*, *Z* derivatives of the filtered gravity anomaly on a 0.25° grid (Figs 1C, D and E) and use them as input to the 3-D Euler equation.

A crustal thickness map of Africa derived from a global gravity field model using Euler deconvolution

Getachew E. Tedla,[1,2] M. van der Meijde,[1] A. A. Nyblade[2,3] and F. D. van der Meer[1]

[1] *University of Twente, Faculty of Geo-Information Sciences and Earth Observation (ITC), Enschede, The Netherlands. E-mail: tedla@itc.nl, get11@psu.edu*
[2] *Department of Geosciences, Pennsylvania State University, University Park, PA 16802, USA*
[3] *School of Geosciences, The University of the Witwatersrand, Johannesburg, South Africa*

● **Pivot Point of crust fragment**

● **Original connection point of crust fragment**

The arabian plate is a composition of at least three crustal fragments (blue marked areas) which moved to their present positions through the magmatic (lithospheric) streams which were caused by the impulse of the impact event. During the divergent movement, the area between the fragments first filled up with magma & water, and then later with sediments.

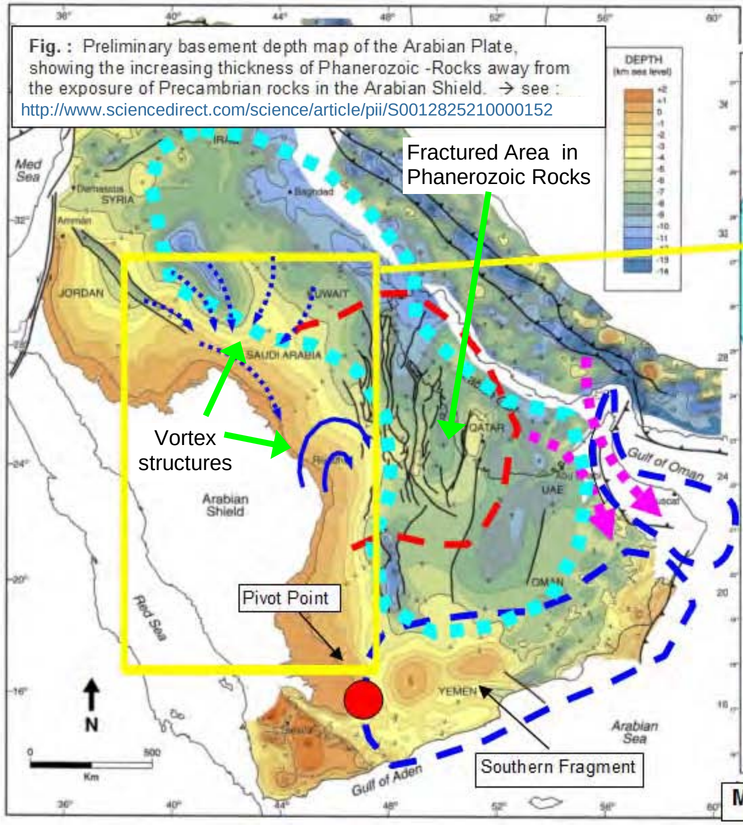
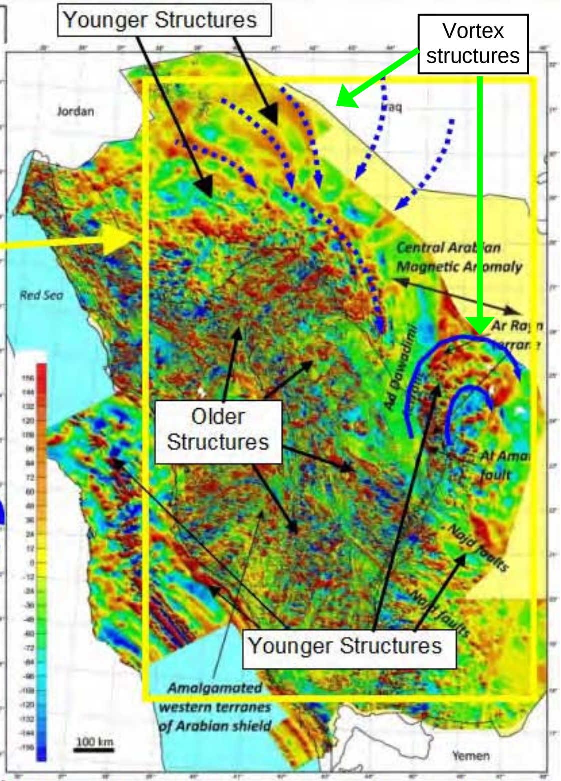
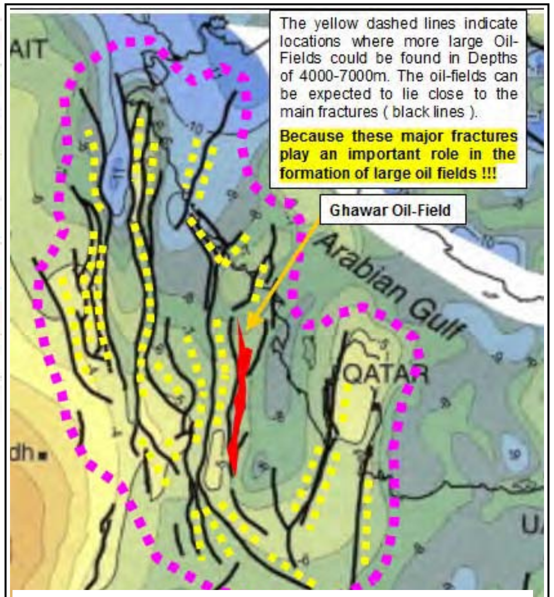


Fig. : Preliminary basement depth map of the Arabian Plate, showing the increasing thickness of Phanerozoic -Rocks away from the exposure of Precambrian rocks in the Arabian Shield. → see :
http://www.sciencedirect.com/science/article/pii/S0012825210000152



Magnetic Anomaly Map of the Arabian Shield area

To the movement of the crust fragments which formed Arabia



The yellow dashed lines indicate locations where more large Oil-Fields could be found in Depths of 4000-7000m. The oil-fields can be expected to lie close to the main fractures (black lines).

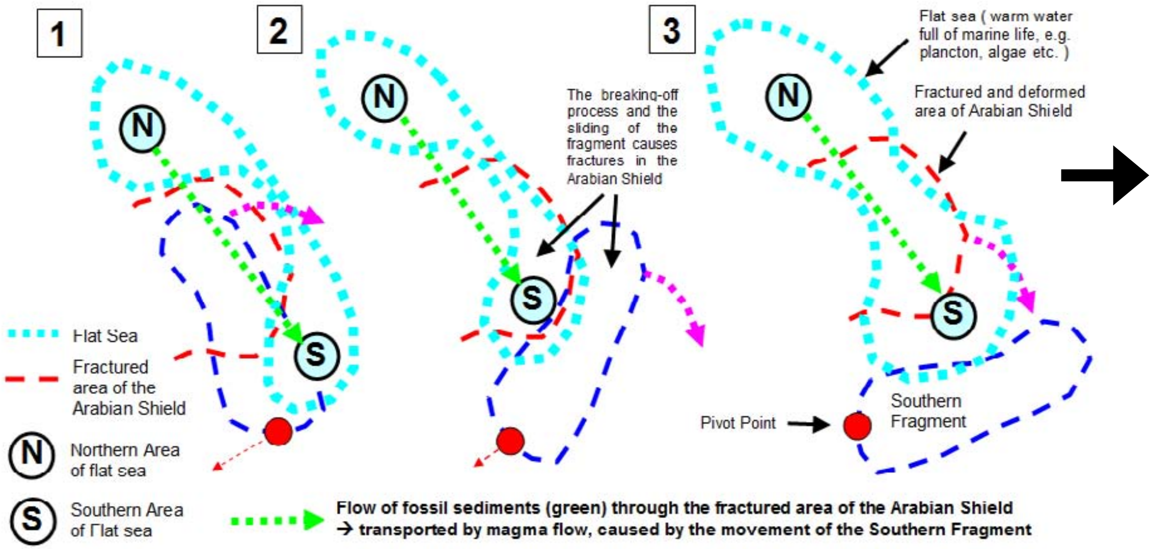
Because these major fractures play an important role in the formation of large oil fields !!!

Fractures are linked to the formation of large oil fields

On the Magnetic Anomaly Map of the Arabian Shield there are different shaped structures noticeable. Here the fine structures represent older geological structures of the Arabian Shield, and the “younger – rough structures” probably indicate the final movement of younger magma streams before they solidified (probably < 150 Ma years ago). There are stream-like structures visible. Even “vortex-like structures” are noticeable (full blue arrows) ! The marked young stream-like structures (blue dashed arrows) indicate that there was a general movement towards a SE-direction of the magma streams. An analysis of a detailed magnetic anomaly map east & north of yellow marked area should confirm this this !

On the east side of the Arabian Shield there are extensive cracks visible, which probably were caused by the divergent movement of the crust fragments. The large **Ghawar Oil-Field** is orientated parallel to this cracks and formed in the initial center of a crater

Chronology of the movement of the Southern Fragment and the development of the Inland Sea → and their effect on the fractured and deformed area on the Arabian Shield



1
2
3
N
S
Flat sea (warm water full of marine life, e.g. plancton, algae etc.)
Fractured and deformed area of Arabian Shield
The breaking-off process and the sliding of the fragment causes fractures in the Arabian Shield
Pivot Point
Southern Fragment
Flat Sea
Fractured area of the Arabian Shield
Northern Area of flat sea
Southern Area of Flat sea

Flow of fossil sediments (green) through the fractured area of the Arabian Shield → transported by magma flow, caused by the movement of the Southern Fragment

Stage 1 : The situation some time after the PT-Impact has caused compression & secondary impacts between Eurasia and Africa. In this stage Africa and the Arabian Shield were already moving away from Eurasia. In Stage 1 the Southern Fragment (blue) starts to rotate around the pivot point (red), caused by the impact impulse & magma streams acting on the Southern Fragment. An Inland sea starts to form

Stage 2 : shows the stage of maximum rotary velocity of the Southern Fragment → This is also the time of the maximum flow of magma and max. production of fossil sediments which accumulated in cracks of the fractured area of the Arabian Shield. Bio-mass was mainly produced close to the initial crater centers → This process created the big oil fields

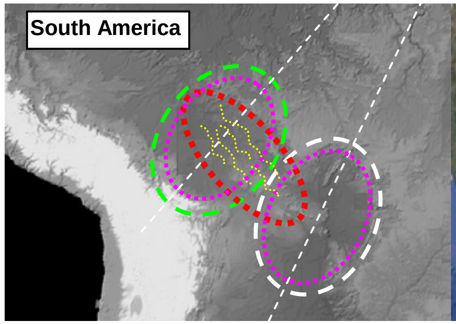
Stage 3 : End state → Southern Fragment in final position → Magma streams stop → Inland Sea, maximum extent → Sedimentation starts

There are >10 impact craters on Earth, where similar large oil-fields, like Ghawar in Saudi Arabia, should exist !

The worlds largest **Ghawar Oil-Field** in Saudi Arabia developed very close to the center of an impact crater with ~ Ø 400 km !! There are more than a dozen similar-size impact craters on Earth, which must have caused similar large oil-fields !! The maps below (→ on the left) indicate the areas were such large oil-fields could be located (areas marked in red → impact areas which are highly fractured). The impact craters are marked in white (or black → Europe). Further potential areas (with increased hydrothermal activity (biomass-development)) are marked in purple.(**Note:** the red and purple ellipses don't represent craters !)

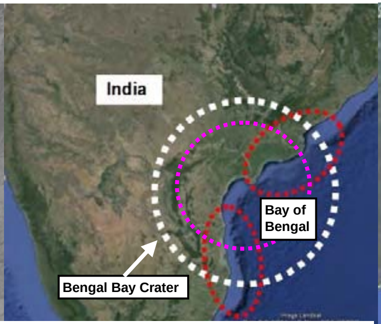
South-America / Pantanal Crater :

The ∅ 840 x 630 km elliptical crater caused a large shift of the NE-part of the continent and must have produced large oil- & gas deposits !



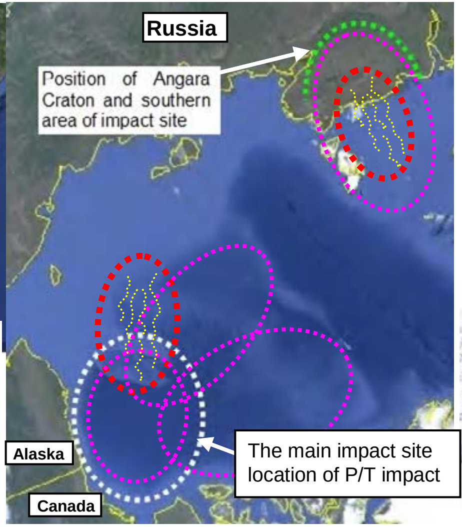
India / Bengal Bay Crater :

The ∅450 x 380km crater has caused the breakaway of India from Pangea. It has produced potential areas along the coast



Permian / Triassic Impact Crater :

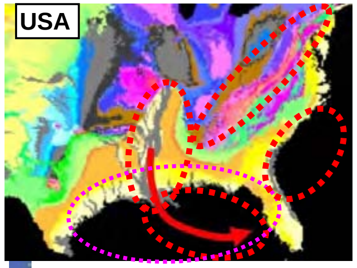
The gigantic ∅1330 x 880km crater has produced large areas with high potential for oil- & gas-deposits. But the deposits probably lie quite deep !



The main impact site location of P/T impact

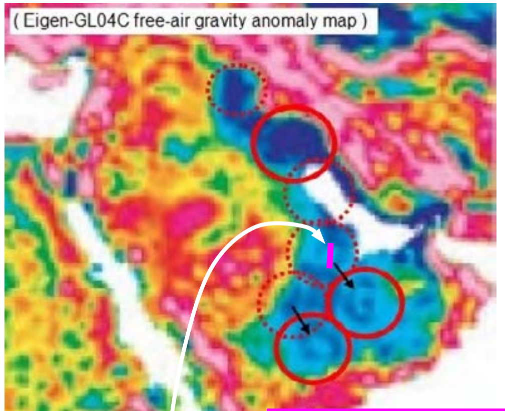
USA / Appalachian Fragment :

The forced movement of the Appalachian fragment caused large oil-, gas- & coal deposits along the path of the fragment



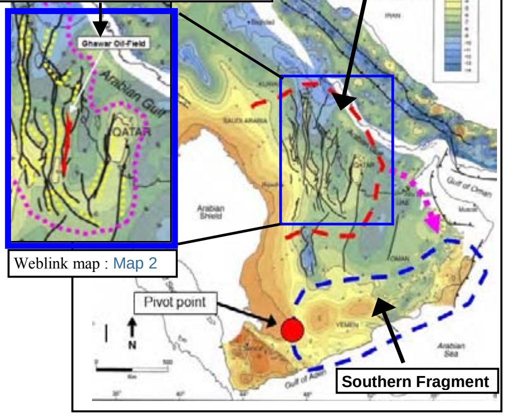
Arabia / (PT) - Secondary Crater Chain :

For comparison a gravity anomaly map of Arabia is shown. This map indicates a chain of impact craters with ∅300-400km (probably secondary craters caused by the P/T-impact), which have split Arabia into 3 crust fragments, and which have caused a divergent motion of these fragments. The impacts have also caused extensive cracks in the Phanerozoic rock underneath Along these cracks large oil-fileds formed !



Note : The Ghawar Oil-Field seems to sit precisely above the initial crater wall of the inner ring of one of the impact craters !!
See weblink → Ghawar Oil-Field

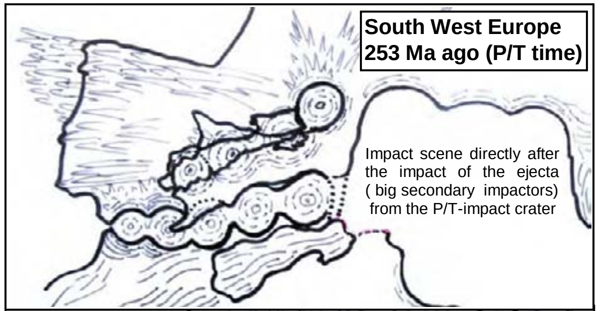
The large **Ghawar-Oil-Field** is orientated parallel to extensive cracks, probably caused by divergent motion of the crust fragments, and located close to a initial crater center

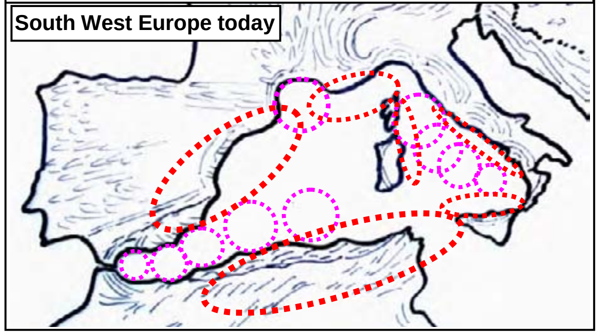


Weblink map : Map 2

Europe / Secondary Crater chains caused by P/T impact event :

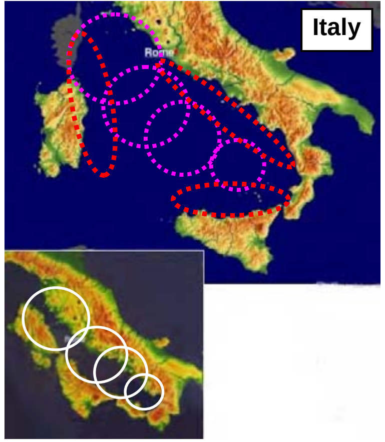
At least two crater chains with craters of up to ∅ 250km were caused by the P/T impact event in South-West Europe 253 Ma ago. The impact event caused many large crust fragments which then drifted eastward. This movement of the crust fragments must have produced large oil- & gas deposits along the coastlines of SW-Europe


South West Europe 253 Ma ago (P/T time)
Impact scene directly after the impact of the ejecta (big secondary impactors) from the P/T-impact crater



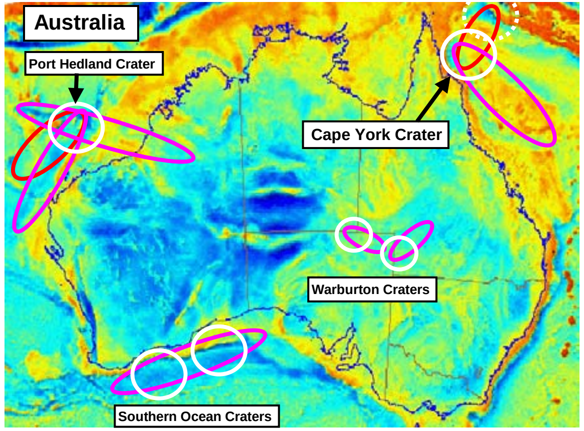
Italy / Secondary Crater chain:

The crater chain with ∅160-220km craters in the Tyrrhenian sea produced potential oil- & gas deposit areas along the coast of Italy, Sicily & Sardinia.



Australia / Impact Craters :

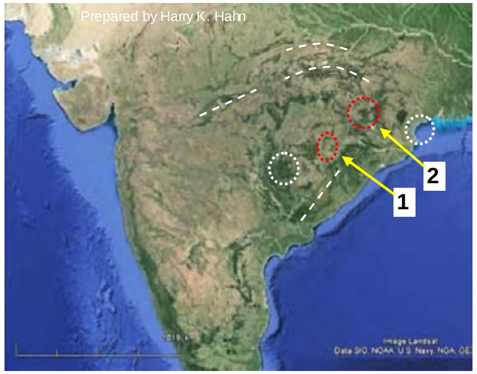
The ∅ 320 km CY-crater and the ∅ 400x350 km PH-crater in the North produced areas with high potential for large oil- & gas-deposits because of the extensive movement of crust fragments. The two SO-craters also have good potential for big deposits



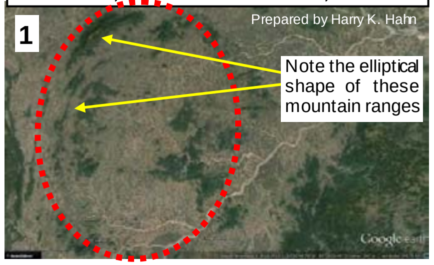
Other possible Impact Structures in India & South-America :

There are other impact structures on Earth which are indicated by topographic features and visible on satellite images (e.g. in Google Earth). I want to show here a few impact structures, which are a bit more difficult to interpret. There are some further structures visible in India which seem to be secondary impact structures caused by the Bengal Bay Crater. And there are further impact structures visible in South-America which seem to be connected to the PT-Impact

Other impact structures in India

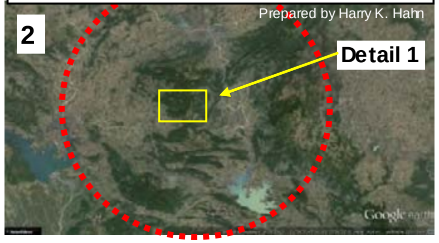

Prepared by Harry K. Hahn
1
2
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

20°26'04,78'' N – 83°59'20,40'' E

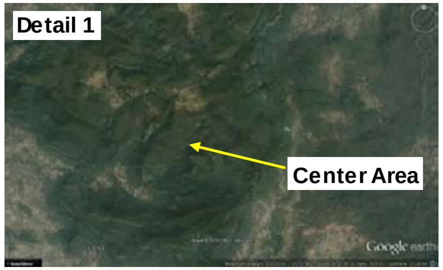

1
Prepared by Harry K. Hahn
Note the elliptical shape of these mountain ranges
Google earth

elliptical structure with ∅ **90x65 km**

21°59'57.45'' N – 85°35'58.53''

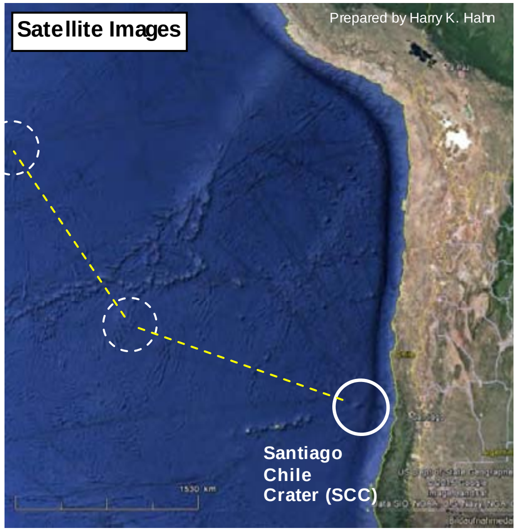


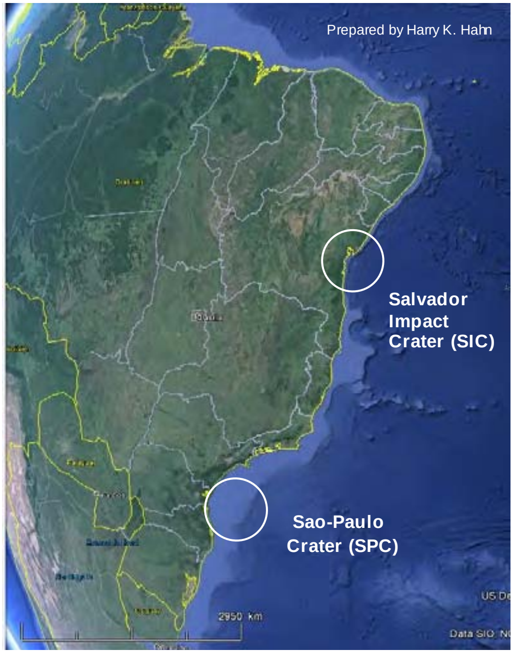
circular structure with ~ ∅ **100 km**



Further impact structures in South-America :

There are two possible impact craters located in two bay-areas on the East-Coast of South-America and one crater on the West-Coast which may also be a secondary crater caused by the PT-Impact Event ~ 253 Ma ago.

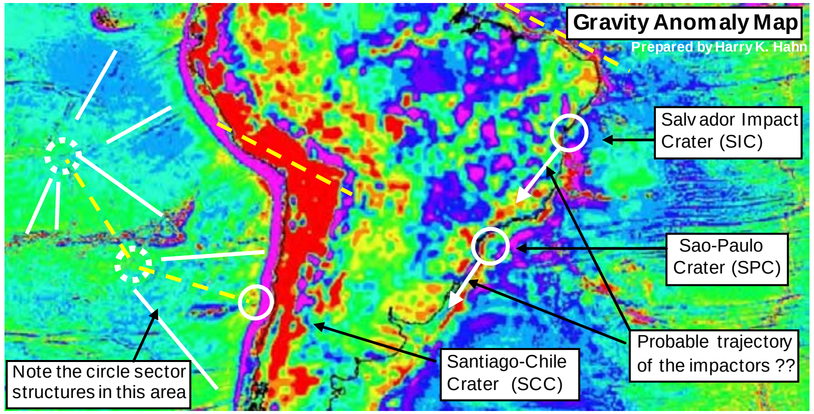


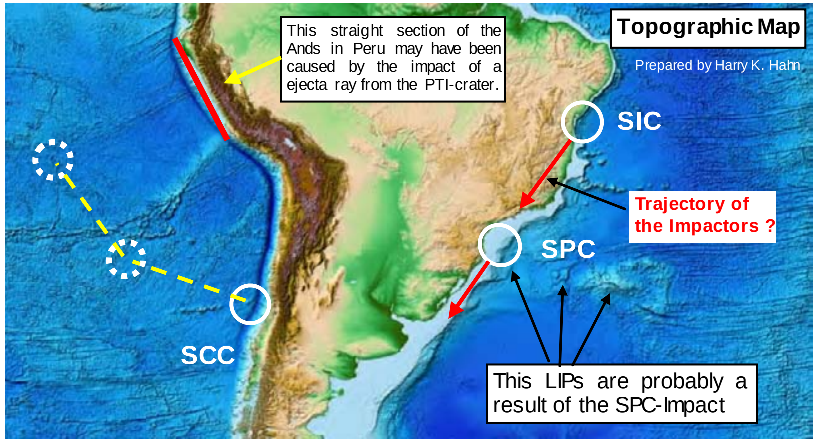


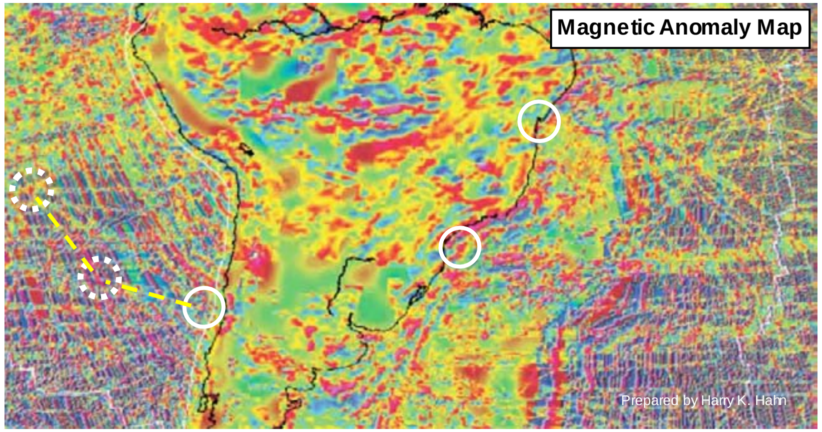
The Gravity Anomaly Map of South-America shows finer structures which indicate two further impact craters in the **300-600 km** diameter range on the East-Coast, and at least one impact-crater or -zone just west of the West-Coast of Chile, which seems to be connected to two structures on the ocean floor (→ the two structures are indicated by white dotted circles).

These structures seem to be traces of two "stops" of this crater (?) or impact-zone in the past, during the ocean floor spreading . Possibly these structures show traces of two magma outbreaks coming from this crater or impact zone, within the last 100 Ma, similar to the traces of Cape York Crater.

The two assumed impact craters on the east coast of South-America, close to Salvador and Sao Paulo (Curitiba) seem to be (at least partly) responsible for the shape of the east-coast of South-America. The Salvador Impact Crater (SIC) may belong to the Ejecta-Ray R3 from the PTI. The Sao Paulo Crater could be caused by ejecta from the PTI or by ejecta from the VLC event


Gravity Anomaly Map
Prepared by Harry K. Hahn
Salvador Impact Crater (SIC)
Sao-Paulo Crater (SPC)
Probable trajectory of the impactors ??
Santiago-Chile Crater (SCC)
Note the circle sector structures in this area


Topographic Map
Prepared by Harry K. Hahn
This straight section of the Ands in Peru may have been caused by the impact of a ejecta ray from the PTI-crater.
SIC
Trajectory of the Impactors ?
SPC
SCC
This LIPs are probably a result of the SPC-Impact

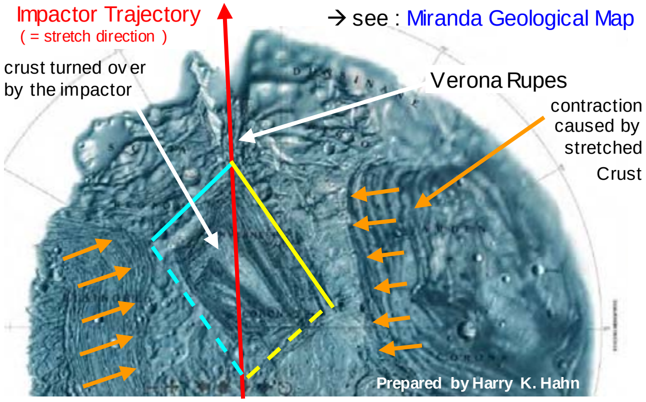


Epilogue

At first a few words to some other planets and moons which need to be analyzed under consideration of the new acquired knowledge about global impact events.

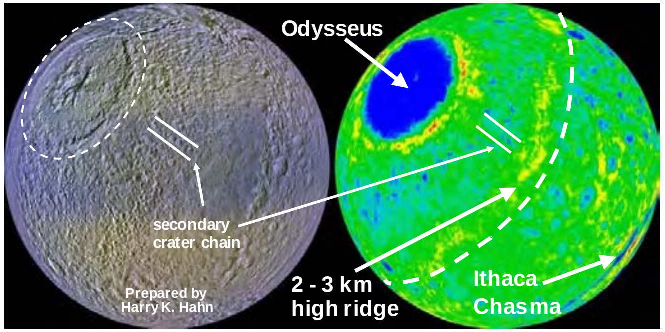
There are many structures noticeable on other planets and moons which seem to be traces of global impact events, but they are not recognized as such yet ! That's why planetary scientists must continue the work which I started with this study !!

For example on Uranus moon **Miranda** there is an impact structure visible, which obviously was caused by a powerful "gazing shot" !
A large impactor seems to have "scratched" along Miranda's surface and has "turned-over" a certain area of Miranda's crust in slow motion (→ like a skin-lobe is cut and turned over by a sharp edge). This caused the triangular-shaped feature on Miranda's surface, which actually shows the deeper layers of Miranda's crust, and it also caused the 5 km deep "Verona Rupes" fault-scarp. Because of the forcefull stretching of Miranda's crust in the triangular shaped area, contraction was caused in perpendicular direction to the impactor trajectory right and left of the stretched area. This caused the bow-shaped "rift-valleys" (cracks) right and left of the "triangular gash" which also show deeper layers of Miranda's crust.


Impactor Trajectory
(= stretch direction)
crust turned over by the impactor
Verona Rupes
contraction caused by stretched Crust
Prepared by Harry K. Hahn

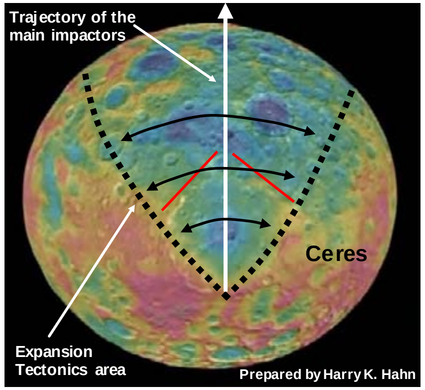
→ see : Miranda Geological Map

Or Saturn's moon **Tethys** with the dominant feature, the 8-kilometer-deep and 440-kilometer-wide Odysseus impact basin. This moon can help to better understand global impact events.
For example the visible 2-3 km high (equatorial) ridge (yellow) may be a tectonic (shock) feature related to the impact event or it may be a deposit formed when the ejecta blasted out of Odysseus, and fell back onto the surface at high velocity. Between the ridge and Odysseus, the surface is scoured & pockmarked, and there are clear visible secondary crater chains in this area. At bottom right can be seen the globe-circling trench Ithaca Chasma, formed as part of Tethys stretched apart.



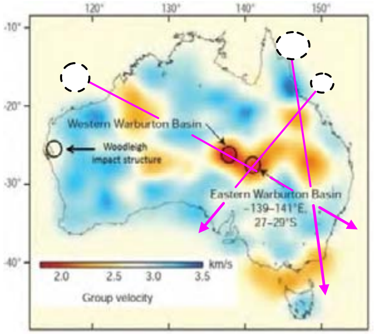
→ see also : animated rotation of Tethys

Or the dwarf planet **Ceres** : Similar as on Earth's Moon, Expansion Tectonics was triggered on Ceres by a global impact event, which was caused by several impactors which impacted simultanously



Like on Earth's Moon volatiles in the mantle, e.g. H_2O (→ in a super-saturated state) must have caused the expansion tectonics visible on Ceres. An indication for that maybe Ahuna Mons which in all probability resulted from cryovolcanic activity

There are also still other large-scale impact structures on Earth which need to be properly analysed, in order to figure out the correct tectonic model for Earth before & after the PT-Impact Event → e.g. the East- & West-Warburton Impact Basins.



→ see image on the left !
There are two craters which formed the East- & West Warburton Basins approx. 300-360 Ma ago (estimated diameter Ø 100-200km each)

Weblinks :
News Article 1 , News Article 2
East-Warburton Basin
Eromanga Basin
(Woodleigh Crater)

And there are still many other large-scale impact structures and large impact craters on Earth !!

And like Miranda, Tethys or Ceres, there are still many moons & dwarf planets in our Solar System which have interesting large-scale (global) impact structures which are not properly analyzed yet !!

However this work must be carried out by experienced planetary scientists & geologists now, together with the analysis of all planets and moons

Because we need to know the root causes of all global impact events which took place in our Solar System and we need to find all impact structures !!

My study may serve as a reference here, which will help the future "Impact Hunters" to find all the still undiscovered craters and impact structures !!
My advices in this regard : You have to look at as many maps as possible. Compare the same areas at different maps and map-types ! Prefer the most precise and most detailed maps ! A good way to find good maps is to type-in the right search-words in Google and then look at the search results under "Images" not unter Web ! In just a few seconds you can scroll through hundreds of maps and Images !! Use your visual cortex for the hunt !

Take time for studying finer details which you believe may be worth to have a closer look at ! Google Earth is a very good tool to “surf around” and have a closer look at topographic details ! Do a dynamic surf and move around the topographic feature and look at it from different angles. This gives you a good 3D-impression of every feature !

And always have a think about what you see on the maps & images ! Think logical and don’t believe everything the mainstream science is trying to tell you ! Because not all of mainstream science is correct ! (→ sometimes on purpose !)

After reading this study about global impact events

What practical measures should be taken ??

1.) The first and most important measure must be the continuation of the research work, regarding global impact events and their causes & effects, which was started with this study here !

Scientists from many different disciplines must take on the challenge to find further evidence for the global impact structures described in this study

2.) Rock samples from all new impact craters and impact structures described in this study should be collected and analyzed.

3.) After the confirmation of the P/T-impact crater and related secondary impact structures a new analysis of the tectonic processes which took place on Earth in the last 253 Ma must be done !

4.) Then the cause of the expansion tectonic process, which obviously was triggered by the P/T-impact, must be found. And because there are other planets & moons in our solar system where expansion tectonic processes were triggered by a global impact event, a teamwork of scientists from different diciplines is required.

To find the driving physical / chemical process for the mantle expansion visible on different planets and moons, a close collaboration of planetary scientists, geophysicists, geologists, chemists and physicists (especially with expertise in fission research and high-pressure / high-temperature material research) Is required.

5.) A more precise and more detailed computer analysis of the collisions (pericenter events) of the Sagittarius Dwarf Galaxy with our galaxy must be done. In all probability debris- (mass) streams resulting from these collisions are the cause of periods of violent global impact events in our solar system !! That’s why it is important to find out the exact composition, extension & the effects of these debris streams, caused by these collisions, on our solar system !!! The starting point of this analysis should be the study from Mr Chris Purcell **Important !! :** Especially the effects and the position of the leading tidal tail of the **Sgr-DG** in the past (-300Ma) & in the future must be studied !!

6.) Because the distribution of metal-ores and energy resources, like crude oil or natural gas in Earth’s crust, is mainly caused and defined by large (global) impact events, knowledge of the precise location and size of all impact craters on Earth is crucial for future explorations of ore deposits, and especially for the exploration and discovery of new large oil- and gas-deposits !!

Good knowledge of all large impact structures on Earth will make a big difference in future explorations, in order to find these important energy- and ore- deposits for mankind !!

Especially the interdependence of big impact craters with the formation and the development of large oil-fields & gas-fields must be precisely analysed !! It seems that in particular the impact-related tectonic motion of crust fragments and magma streams, which were created during large impact events, are an important condition for the development of large oil- and gas deposits !!

This interdependency must be studied & analysed !

After having seen and analyzed all the global impact events and the global destruction on many planets and moons of our Solar System :

THE FOLLOWING WARNING MUST BE GIVEN :

We must consider different worst case scenarios in regards to one or more impactors (asteroids or comets) which are on a collision course with our planet Earth !!! And we must find solutions, and build and install suitable defence technology in space, in order to deflect the impactors of all assumed worst case scenarios away from Earth !!!

Possible Worst Case Scenarios to consider !! :

1.) Accumulations of Asteroids and/or Comets with a density like in the Asteroid Belt are approaching from deep space and they are on a collision course with Earth, having velocities up to 100 km/s !!

2.) Up to 10 Asteroids in the diameter range of ø 10–40 km with velocities of 20-100 km/s are on a collision course with Earth and all are arriving at the same time !! Pre-Warning Time < 18 months !!!

3.) A large Asteroid with ø 200 km and a velocity of 100 km/s is approaching from deep space (from outside the solar system !!) and is on a collision course with Earth. Pre-Warning Time < 2 years !!!

As long as we don’t exactly know what astrophysical processes have caused the global impact events within the last 300 million years, described in this study, we must take sufficient precautions !! in this violent and merciless universe !!

Because if we don’t do so !!, Mankind and most other species on Earth could go extinct within a very short time !!, just like the Dinosaurs !!!

There are already some ideas and plans for the realization of technology to deflect small asteroids.

But every idea or plan which I have seen so far regarding the deflection of an asteroid or comet is far away from being able to cope with one of the described worst case scenarios !!!

If we are very lucky we could survive Worst Case Scenario 1.) But only if all asteroids or comets > Ø 10 – 20 km would miss our planet Earth !!! Because we are not able to deflect such large impactors yet !!! We just don't have the required defense capability and technology to do that !!!

I have made an own assessment, and I found a few suitable defense strategies which are able to cope with large impactors, up to Ø 200 km !!

However these strategies only work if the required technology is installed in space (in defined locations in our solar system !) and if we are ready (well trained !!) to use this technology. And it would only be possible to cope with high-velocity Asteroids or Comets (with velocities >30-40 km/s) if the technology is installed with maximum drive performance which is possible and if it would be installed on many locations in our solar system !!!

It would probably take at least 20 years to design, build and install such a defense system and it would probably cost ≥ US$ 100 billion !!!

However if all members of the UNO cooperate in the effort to build such a defense system for our planet Earth, then it shouldn't be a problem to finance it !!! And it also should't be a problem to convince the UNO members to invest in such a defense system for our planet Earth !!

Because this is really the only possible insurance against a global impact event and the extinction of mankind and the total destruction of our world !!

And we shouldn't wait until the devil comes around the corner ! Fast action with intelligence is required !

How such a defense system for our planet Earth could look like is described in my following study :

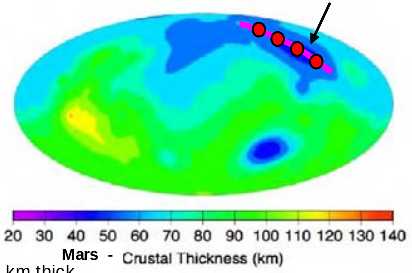
→ "To the deflection of asteroids in the diameter range of 5 to 200 Km"

The interested readers should also have a look at the following Wikipedia page :

→ Asteroid Impact Avoidance Strategies

The strategies and the technology described in my above mentioned study can also be used for doing Terra-Forming on Mars and on other planets & moons

With the described asteroid deflection strategies it would be possible to carry out controlled impacts of asteroids in the 10-20 km diameter range on Mars and on other planets & moons !!

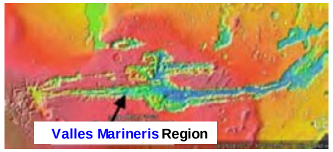


Ø 10-20 km impactors produce a crater chain which causes a crack

Mars - Crustal Thickness (km)

With a controlled impact series of probably 3 to 4 impactors in the Ø 10-20 km range a crack in the crust of Mars could be produced.

In order to achieve this crack with the smallest possible impactor diameter & energy expense, the optimum area for the Intented crack would be the crust area of Mars which is thinnest. This is in the center area of the northern lowland (→ the former ocean floor on Mars) Here the crust is only 40 km thick A large crack in this area should cause large amounts of volatiles (e.g. H_2O) to rise up to the surface, similar as it happened in Valles Marineris. This would produce a small ocean and a thicker atmosphere !!! Such a Terra-Forming project should first be tested on another planet or moon which is located further away from Earth, e.g. on Jupiters moon Ganymede or on Enceladus .

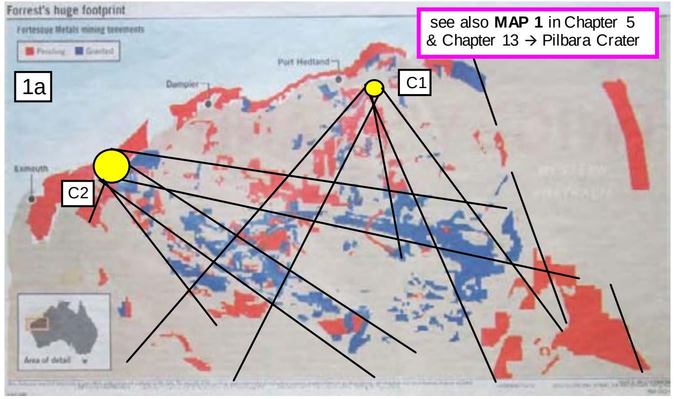


Valles Marineris Region

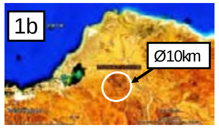
Now a few general points which I want to address to political leaders and to the decision makers in expert committees and in the mining industy etc.

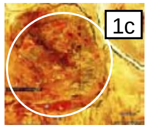
It is not acceptable that mining companies or national-, or private scientific institutions keep important scientific knowledge (egoistically) for themselves !! Because this seems to be the case for some (mining-related) Impact-Research !!

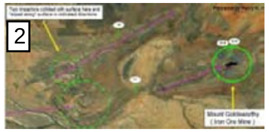
Of course there are some obvious reasons for such a behaviour ! : to maintain a monopoly in the mining sector and on the commodity markets, and because of geo-strategical reasons of course !



see also **MAP 1** in Chapter 5 & Chapter 13 → Pilbara Crater







The image **1a** shown above, illustrates the tenements (claims) of FMG the 4th biggest iron-ore mining company of the world. The tenements can clearly be allocated to two impact structures (craters) !! I have shown one of the two impact structures (C1) more detailed in image **1b & 1c**.

→ It is also described in **Chapter 5 (→ Map 1) & 13** !

C2 must be an approx Ø 50km crater near Exmouth

The iron ore in the tenements (red/blue) was ejected from the two impact structures (craters) ! And probably the management of FMG knows that !

Image **2** shows the "Goldsworthy" Iron Ore mine which has produced the highest-grade iron ore in the world ! It belongs to another one of the four biggest Iron Ore mining companies in the world. "Goldsworthy" is part of a big impact structure, but the World's Geological Society doesn't know it !

I also want to refer to Planetary Geology where NASA seems to hold back certain scientific discoveries regarding global impact structures !

→ see the chapters 1, 6, 7, 8b & 17 of my study !

It seems that some companies & institutions want to keep supremacy in the economical important science of Impact Geology ! This is unacceptable !

And I advice everyone to have a good think about such an unacceptable situation, where the worldwide exploration-industry & the geo-sciences aren't fully informed about important discoveries !!

This is a serious mistake which could backfire !

I also advice to **have a good look at the diagram on the frontpage ! → Graph No. 5** describes our trouble in a merciless mathematical way !

→ What you can read from Graph No. 5 :

In all of human history (>2 million years) mankind consumed less than 10 % of all resources of our planet Earth (→ up to around 1985).

However in the very short time-frame of just 50 years, from 1985 to 2035 mankind will consume **50 %** of all of Earth's resources !!! This is the serious consequence of the exponential growth of mankind up to around the year 2000 !!

And we will need an **extremely large amount** of resources in a very short time frame !!!

Here a few interesting movies which explain the serious consequences of exponential growth :

Limits to Growth_Is the prediction going to happen ?

7 Billion : How did we get so Big so Fast ? ↓

Exponential Growth Please also watch → Part 2 !!!

We have unleashed a global physical process, pretty much the consumption of our planet in just 100 years, which is nearly uncontrollable by political or executive measures !!

Political and executive measures can only slightly and slowly change (→restrict) this consumption process. But politicians won't have a choice ! This is exactly what they have to do in the next 50 years with all the executive power they have available !! In biology an exponential growth process always ends with the rapid collapse of the growth ! This is a natural law !! We will be no exception ! In this regard mankind acts like a fungus which eats up its host (e.g. an apple !) in an exponential growing devour orgy !! (see Info !)

This means mankind's (our) Collective Intelligence is not better than the one of a primitive fungus !! We urgently need to develop a **global** intelligence which is better than the one of a primitive fungus !!

Otherwise we will exactly end up like the fungus !! The majority of us could die within a few decades, maybe as a result of a global nuclear war, caused by a geo-strategical panic reaction of an individual government, with too much power over a nuclear military apparatus, or we may just die of starvation

To prevent such a gloomy scenario we, as an advanced intelligent species, must act as follows :

1.) All countries of the world must work together, and not against each other !! , in order to manage Earth's resources in the best possible way !!

And we must stop spreading weapons !!. More weapons means more Resource-Wars & Terror !!

2.) The UNO, the G20 and G8 must organize the controlled exploitation of Earth's resources to avoid dangerous resource wars, and they must make sure that there is price stability in the longterm on all commodity markets. This means these organisations must regulate the placing & allocation of mining licences worldwide (etc.), in order to achieve a sustainable, clean, peaceful and stable exploitation of Earth's resources !

The UNO, UN-Security Council and the G20 must decide the future of the world not CIA's & military ! And diplomacy must always override military plans

3.) We must make it a habbit to consume less !! , and not more !! (the investment bankers won't like to hear that !). But we must tighten our belt !! This is especially important for energy consumption and consumption of agricultural goods which require vast land areas like cattle and sheeps (meat), or a lot of water like cotton. And we must grow more plants (vegetarian-food) instead of meat which needs considerable less land area !

4.) We must restrict the world population growth !!

5.) We must start to settle on Mars ! Mars will act as a valve ! The future destination for emigration !

6.) Water is a key-resource of our future on Earth and on Mars !! We must find new technology to produce large amounts of drinking water from sea-(salt)-water with a minimum expense on energy !!

Altogether there are enough resource deposits to discover on Earth, to ship mankind safe through the difficult waters of the next 50 years ! But only if we apply worldwide the correct impact-related tectonic model of Earth !! Just remember incorrect world models in the past ! see : Copernicus & Galileo

We also have to push Fusion-Reactor-Technology and Fusion-Drive-Technology forward more rapidly because it represents an unlimited energy resource, and we need it for a fast colonization of Mars and the colonization of other planets & moons

Who was informed about my research & my study :

In June & December 2012, I informed around 10 Geologists & Impact Researchers in Germany & Austria about the impact events in East-Australia and in the Pilbara Region (e.g. Prof. C. Koeberl & Dr Ferriere, Prof. Kenkmann & Dr Poelchau, & Prof Reimold), and even some rock samples were sent for analyzing. But I haven't received feedback yet. (I also want to inform the above mentioned about this study !). Early in October 2015 I informed a few geologists and the head office from University Karlsruhe about the assumed location & structure of the P/T-Impact Event and about most of the other impact structures and global impact events described in the current version of my study. I have only received two short answers so far, which said the following : "The contents of my study isn't explainable with the current state of Geophysics" Of course that's no wonder ! Because Geophysics doesn't know anything yet about the biggest impact structures on Earth !! These impact structures are shown for the first time ever in this study !!! ;-)

References

Tectonics

1. An Yin. Mark Harrison : **The Tectonic Evolution of Asia ,** California, Los Angeles 1996, Cambridge University Press ; ISBN: 0-521-48049-3
2. A.H.F. Robertson, D. Mountrakis : **Tectonic Development of the Eastern Mediterranean Region** ; Geological Society, Special Publication 260
3. G. Moratti, A. Chalouan : **Tectonics of the Western Mediterranean and North Africa** ; Geological Society, Special Publication 262 ; London 2006
4. W. Frisch, M. Meschede, Ronald Blakey : **Plate Tectonics** ; Germany 2011, Springer Verlag ; ISBN : 978-3-540-76503-5 , (e-ISBN: ...-76504-2)
5. G.R. Foulger, D-M. Jurdy : **Plates, Plumes, and Planetary Processes** ; The Geological Society of America, Special Paper 430 ; Boulder Colorado 2007 ; ISBN: 978-0-8137-2430-0

   Interesting Chapters : 1.) **Speculations on Cretaceous tectonic history of the northwest Pacific and a tectonic origin for the Hawaii hotspot** ; Ian O. Norton 2.) **An alternative Venus** ; Warren B. Hamilton. 3.) **The OIB paradox** ; J. Godfrey
6. R. Hekinian, P. Stoffers, J.L. Cheminee : **Oceanic Hotspots** ; Germany 2004, Springer Verlag ; ISBN: 3-540-40859-2
7. P. Kearey, F.J. Vine : **Global Tectonics** , England 1996, Blackwell Science Ltd. , ISBN : 0-86542-924-3
8. **The African-Superplume (LLSVP) a whole mantle structure, Start at 33 minutes** by Andy Nyblade, from the University of the Witwatersrand (South-Africa)
9. Two studies about Carbonatite Lava : Study 1, Study 2 **see also:** Movie 1, Movie 2
10. **Permian-Triassic Extinction Event :** → Two informative studies about the P/T-event Study 1 : Study_1 ; Study 2 : Study_2

Impact Cratering

8. C. Koeberl, F. Martinez-Ruiz : **Impact Markers in the Stratigraphic Record** 2003 ; Springer Verlag ; ISBN : 3-540-00630-3
9. G. R. Osinski, E. Pierazzo : **Impact Cratering** ; USA 2013, Wiley-Blackwell Publication ; ISBN : 978-1-4051-9829-5
   → companian website of book : www.wiley.com/go/osinski/impactcratering
10. W.U. Reimold, R.L. Gibson : **Meteorite Impact** ; Council for Geoscience, Germany 2009, Springer Verlag
11. R.L. Gibson, W.U. Reimold : **Large Meteorite Impacts and Planetary Evolution IV** ; The Geological Society of America, Special Paper 465 Boulder Colorado 2010 ; ISBN: 978-0-8137-2465-2

Planetary Geology

12. I. De Pater, J.J.Lissauer : **Planetary Sciences** ; USA 2010, Cambridge University Press , ISBN : 978-0-521-85371-2
13. Ronald Greeley : **Planetary Geomorphology** ; USA 2013, Cambridge University Press ; ISBN : 978-0-521-86711-5
14. M.R. Balme, A.S. Bargery, C.J. Galllagher : **Martian Geomorphology** ; Geological Soc. London 2011 Special Publ. 356, ISBN: 978-1-86239-330-1

    Interesting Chapters: 1.) **Morphological and geographical evidence for the origin of Phobos' grooves from HRSC Mars Express images** ; J.B. Murray, J.C. ILIFFE 2.) **Periglacial geomorphology and landscape evolution of the Tempe Terra region, Mars** ; S.van Gasselt, E.Hauber, A.-P. Rossi, A. Dumke u.a 3.) **Geol. recent water flow in the NE Sulci Gordii region, Mars** ; M.C.Towner...
15. C. Vita-Finzi, D. Fortes : **Planetary Geology** ; London 2013, Dunedin Publ.
16. Kent C. Condie : **Earth as an Evolving Planetary System** ; 2011, Elsevier Academic Press, ISBN : 978-0-12-385227-4
17. J.I.Lunine : **Earth Evolution of a Habitable World** ; 2013 , Cambridge University Press, ISBN : 978-0-521-85001-8

Interesting Online Documents & Websites :

Note : If weblinks don't work, then type-in or copy the shown web-address directly in your internet browser, or search with titel & author !

Images of **Rock-samples & Sample sites** of some of the described impact structures can be found on these websites : www.permiantriassic.at or www.permiantriassic.de

1.) Introduction : **Impact Metamorphism** , by Dr. Ludovic Ferriere
→ http://www.meteorimpactonearth.com/impactmeta.html

2.) **Numerical modelling of basin-scale impact crater formation**; R.W.K. Potter
→ http://www.lpi.usra.edu/lpi/potter/publications/RossThesis.pdf, **see also**: Orientale impact

3.) **Cycles in fossil diversity** : R.A. Rohde, R.A. Muller, 2005, www.nature.com
→ http://muller.lbl.gov/papers/Rohde-Muller-Nature.pdf → see Introduction in my study

4.) **The Sagittarius impact as an architect of spirality and outer rings in the Milky Way**, C.W. Purcell & others, → see also : Computer Simulation
→ http://arxiv.org/ftp/arxiv/papers/1109/1109.2918.pdf - (www.youtube.com → type in titel !)
→Presentation: http://hipacc.ucsc.edu/Lecture%20Slides/GalaxyWorkshopSlides/purcell_santacruz2011.pdf

5.) **Asteroid/Comet Impact Craters and Mass Extinctions** , Michael Paine
→ http://users.tpg.com.au/users/tps-seti/crater.html

6.) **Brooks Range (Alaska) Orthogneiss : SHRIMP Zircon Analysis of the complex U-Pb situation** ; USA 1999, J.Toro, W.C. McClelland, T. Ireland

→ http://pages.geo.wvu.edu/~jtoro/Research/shrimp/shrimp.htm → Chapter 2 in my study

7.) **A Breakup of Pangaea and plate kinematics of the central Atlantic and Atlas regions**, A.Schettino, E.Turco → http://gji.oxfordjournals.org/content/178/2/1078.full

8.) **Stresses that drive the Plates from below**, Peter Bird, Z. Liu, & W. K. Rucker
→ http://peterbird.name/publications/2008_torque_balances/2008_torque_balances.htm

9.) **A crustal thickness map of Africa derived from a global gravity field model** ;
G.E. Tedla & others, Geophysical Journal International 2011
→ http://www.africaarray.psu.edu/publications/pdfs/Tedla_et_al_GJI_2011.pdf → see Ch.4

10) **Fraser Range – West-Australia** : current theory of the geology explained
→ http://www.oriongold.com.au/wa-fraser-range → see last page in Chapter 5 in my study

11) **Triassic-Jurrassic Rifting : Continental Breakup and the Origin of the...**
Chapter : **Eastern North American quarz tholeiites..** , J.H. Puffer...
www.books.google.de → Search : → type in : **Ti quartz tholeiite**

12) **To the deflection of Asteroids in the diameter range 5 to 200km**; Harry K. Hahn
→https://archive.org/details/ToTheDeflectionOfAsteroidsInTheDiameterRangeOf5To200Km

13) **Ghawar / Saudi Arabia - The world's largest oil-field**, Energy Consulting Group
→ http://energy-cg.com/OPEC/SaudiArabia/OPEC_SaudiArabia_Ghawar.html

14) Publications of **Dr Andrew Glikson**: →http://archanth.anu.edu.au/staff/dr-andrew-glikson
→ Studies about large-scale impact events in Australia

15) **Info to the Sagittarius Dwarf (Elliptical) Galaxy (SagDEG) :**
http://www.solstation.com/x-objects/sag-deg.htm

16) **A 2MASS ALL-SKY VIEW OF THE SAGITTARIUS DWARF GALAXY. V. VARIATION OF THE METALLICITY DISTRIBUTION FUNCTION ALONG THE SAGITTARIUS STREAM**
→ http://authors.library.caltech.edu/16714/1/CHOapj07.pdf

17) **Galaxy: VI. s-Process and Titanium Abundance Variations Along the Sagittarius Stream**
→ http://arxiv.org/pdf/0911.4364v1.pdf

Animations, Simulations & Movies in the Web :

1.) **3D-Impact Crater Simulation** , Museum für Naturkunde / Berlin
→ **Clic on the images to run the animation !! :**
→ http://www.isale-code.de/redmine/projects/isale/wiki/Media
(Especially watch the 3. animation !! clic on the thirth image !)

2.) **The Sagittarius Impact as an Architect of Spirality and Outer Rings in the Milky Way**
→ https://www.youtube.com/watch?v=pig-uqRehNM&feature=youtu.be

3.) **Two more animations which show the current collision situation with the Sgr-DG !**
Sagittarius Dwarf Galaxy flyaround : → https://www.youtube.com/watch?v=qfujsDMl0jU
The Sagittarius Dwarf galaxy and the Milky Way → https://www.youtube.com/watch?v=SxJkTDtCG5w

4.) **Ganymede - Rotating Globe Geology** , NASA Jet Propulsion Laboratory
→ https://www.youtube.com/watch?v=Jkerr60mhf8

5.) **Mars - Rotating Globe Geology, Topography & Gravity texture** , USGS
→ Geology : https://www.youtube.com/watch?v=quZMhSohIEU
→ Topography : https://www.youtube.com/watch?v=TFmWI5O9My4
→ Topography & Gravity Map : https://www.youtube.com/watch?v=BIPKqLwmxK0

6.) **Permian-Triassic Extinction Event :** → Three informative movies about the P/T-event
PT_Movie 1 ; PT_Movie 2 ; PT_Movie 3

7.) Global 3D-tomographic model of Earth's mantle , by David Pugmire & others
→ Ajoint Tomography was used. Simulation made with ORNL Supercomputer

8.) The Ring of Fire from below (Earth's mantle) , by Scott Burdick

7.) **At last : Titanic Impact Energy unleashed !! Andromeda/Milky Way Collision**
→ **A must-seen for Impact-Researchers !!:** https://www.youtube.com/watch?v=PrIk6dKcdoU
From Prof. Jeffrey Kenney from Yale University
→ **See also the following animation :** https://www.youtube.com/watch?v=1keSq3Wg024

References regarding the Global Expansion Tectonics Theory :

1.) **Global Expansion Tectonics - A more rational explanation** - by James Maxlow
→ http://tmgnow.com/repository/global/expanding_earth.html → see Introduction in my study

2.) **Website of Dr. James Maxlow :** http://www.jamesmaxlow.com/

3.) **The expanding Earth: a sound idea for the new millennium** , Giancarlo Scalera
→ http://www.earth-prints.org/bitstream/2122/1152/1/A%20SOUND%20IDEA%20....pdf

4.) **Expansion Tectonics** ; → http://db.naturalphilosophy.org/topic/?topicid=1

5.) **Expanding Earth vs. Plate Tectonics** , Geologist 2010, Timothy Casey B.Sc.
→ http://expansion.geologist-1011.net/

6.) **Microscopic structure of water at elevated pressures and temperatures**
C.J.Sahle & others → http://www.pnas.org/content/110/16/6301.full.pdf

7.) **Factors Influencing the Eruption of Water-Based Magmas through Europa's Ice Crust.** L. Wilson, J.W. Head; → http://www.lpi.usra.edu/meetings/lpsc97/pdf/1139.PDF

8.) **Water content in arc basaltic magma in the Northeast Japan and Izu arcs**
M.Ushioda ...; → http://www.earth-planets-space.com/content/pdf/1880-5981-66-127.pdf

9.) **Role of Water in Magma Generation and Initiation of Diapiric Uprise in the Mantle**, P.J.Wyllie, → http://authors.library.caltech.edu/51417/1/jgr12274.pdf

10) **Volatiles in subduction zone magmas** , USA 2003, P.J.Wallace
→ http://www.geo.mtu.edu/EHaz/ConvergentPlatesClass/wallace/Wallace_2005_SOTA.pdf

11) **Composition of Earth's mantle → new research results**, Li Zhang , Yue Meng
http://www.anl.gov/articles/composition-earth-s-mantle-revisited-thanks-research-argonne-s-advanced-photon-source